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ABSTRACT

Computerized adaptive testing (CAT) offers the opportunity to replace paper-and-pencil aptitude tests such as the Armed Services Vocational Aptitude Battery with shorter, more accurate, and more secure computer-administered tests. Its potential advantages need to be verified by experimental administration of automated tests to military recruit applicants whose subsequent training and job performance could be correlated with their CAT performance. A hardware and software system was developed for experimental administration of computerized aptitude tests to military personnel. A network of microprocessors was used, with each testing station including an Apple III personal computer. Eight such computers shared a 10 million byte Winchester disk containing the data base of items, programs, and examinee records. This report contains the system and user documentation. (Author/DWH)

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NPRDC TR 84-33

MARCH 1984

MICROCOMPUTER NETWORK FOR COMPUTERIZED ADAPTIVE TESTING (CAT)

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MICROCOMPUTER NETWORK FOR COMPUTERIZED ADAPTIVE TESTING (CAT)

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Computerized adaptive testing (CAT) offers the opportunity to replace paper-and-pencil aptitude tests with shorter, more accurate, and more secure computer-administered tests. Its potential advantages needed to be verified by experimental administration of automated tests to military personnel whose subsequent training and job performance could be correlated with their CAT performance. A hardware and software system was developed for experimental administration of computerized aptitude tests to military personnel. A network of microprocessors was used, with each

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testing station including an Apple III personal computer. Eight such computers shared a 10-million byte Winchester disk containing the data base of items, programs, and examinee records. This report contains the system documentation, and user documentation. A supplement to this report, which is available upon request to NAVPERSRANDCEN, Code 62, provides Pascal source program listings for the experimental CAT system.

FOREWORD

A joint-service coordinated effort is in progress to develop a computerized adaptive testing (CAT) system and to evaluate its potential for use in the military entrance processing stations as a replacement for the Armed Services Vocational Aptitude Battery (ASVAB) printed tests. The Department of the Navy (Headquarters, U.S. Marine Corps) has been designated as lead service for CAT system development; and the Navy Personnel Research and Development Center, as lead laboratory. This effort is being conducted in support of project ZF63-521-030-101-04.12 (USMC Computerized Adaptive Testing).

This report is the eighth in a series being issued under the CAT project. The first six reports described CAT system functional requirements and schedules, preliminary design considerations, the influence of fallible item parameters on adaptive testing, the relationship between corresponding ASVAB and CAT tests, a theoretical foundation for adaptive administration of aptitude tests, and a screening test to be used at recruiting stations to predict ASVAB performance (NPRDC Tech. Note 82-22 and Tech. Reps. 82-52, 83-15, 83-27, 83-32, and 84-17). The seventh report provided a manual describing the experimental CAT hardware system and test administration procedures (NPRDC Tech. Rep. 84-32). This report provides CAT system and user documentation, which is intended to acquaint users and programmers with the Navy Personnel Research and Development Center (NAVPERSRANDCEN) experimental CAT system. Much of the information is technical, describing data structure files, and program construction. A supplement to this report, which is available upon request from NAVPERSRANDCEN (Code 62), provides the complete Pascal program listings for the system.

Results are intended for use by the professional community, Department of Defense laboratories, and their contractors working on the development of CAT.

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INTRODUCTION

Background and Problem

Computerized adaptive testing (CAT) offers the opportunity to replace the current paper-and-pencil Armed Services Vocational Aptitude Battery (ASVAB) with shorter, more accurate, and more secure computer-administered tests (McBride, 1979). The potential advantages of CAT over the current paper-and-pencil tests need to be verified before CAT can be approved for operational use in the enlistment testing program. This verification requires experimental administration of a battery of automated tests to military personnel whose subsequent training and job performance can be tracked and correlated with their CAT test performance.

Objective

The objective of this effort was to provide a hardware and software system suitable for experimental administration of various computerized aptitude tests to military recruit applicants. The basic system specifications were modeled after the minimal requirements listed by DeWitt and Weiss (1974) for an earlier CAT system developed at the University of Minnesota. Unlike the Minnesota CAT system, which was implemented on a time-sharing computer, the Navy Personnel Research and Development Center (NAVPERS-RANDCEN) CAT system had to be sufficiently portable so that it could be moved between military service installations every few months. At the same time, it had to be powerful enough to maintain a data base of several thousand test items, including both text and graphics, to select a subset of test items appropriate to each examinee, to display the items rapidly, and to score the examinee's responses.

Approach

The approach was to use a network of microprocessors, or "personal computers," for testing. Each testing station consisted of an Apple III personal computer containing its own logic, memory, keyboard, and graphics display capability (Hardwick, Eastman, Cooper, & Vicino, 1984). Eight such computers were connected to a multiplexer interfaced with a 10-million-byte Winchester disk containing the data base of test items, programs, and examinee records. System reliability was maintained at a high level by having replacement units on hand in case any single component failed. Software transportability and modifiability were greatly facilitated by using the machine-independent structured programming language, UCSD Pascal.

Results

A highly reliable, portable, and modular system was developed and is in experimental use, adaptively administering tests similar to ASVAB in Navy, Marine Corps, Air Force, and Army training centers. Appendices A and B contain all of the user and programmer documentation necessary for the operation and maintenance of the system. A supplement to this report, which is available upon request from NAVPERSRANDCEN (Code 62), provides the complete Pascal program listings for the CAT system.

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GLOSSARY

Bayesian	Used in Bayesian statistical estimation. The NAVPERSRANDCEN CAT system uses Owen's (1975) Bayesian estimation procedures to calculate ability and variance of estimates. It does not use Bayesian item selection; instead, information maximization is used.
CAT	Computerized adaptive testing.
CATDATA	Name of the file directory that contains the executable code files for the CAT system.
CATPROJECT	Name of this particular development project, also the name of the executable file of the program.
codefile	Files that contain the P-code translation of a program.
CORVUS	Peripheral hard disk storage device manufactured by Corvus Systems, Inc. With a program called Constellation and a multiplexor, the Corvus is used to link up to eight Apple III microcomputers to its central hard disk storage.
data file	File containing data to be used by the program (e.g., the infotable). Format for these files is specified by the user.
DEMO	A demonstration program mode available in Test Administration that prevents data from being written to the hard disk.
driver	A main program that is connected to and calls other slave programs.
examinee	Person taking the CAT system test.
file space	Storage available in files.
fotofile	A file containing a computerized graphics picture.
GRAFIX	Computer mode that sets the computer parameters for graphics programming.
gotoxy	Pascal command directing cursor to a character location on the screen.
infotable	Matrix table of 20 item IDs by 36 ability levels. This table is used in the test strategy to select the sequence of questions for the examinee. For a given ability level (row), the item IDs are listed in order of decreasing information. The first item ID is the one with the greatest information of all the items in the pool for that level.
infovalue	The value of the information function of a particular item at a particular ability level. Each question in the data base is assigned a value calculated from three probability parameters. The CAT system chooses several questions with the largest assigned values and from these randomly selects a question to administer an examinee.

item block	Field in a record of linked list pointers in the question data base. This field specifies the block in an ASCII file in which text to a question is located. (See Appendix A, p. 28, for diagram.)
item code	Pointer field in the subtest directory record. Item code indicates the location of a question's data and parameters in a separate file. (See Appendix A, p. 28, for diagram.)
item pool	The complete list of questions for a subtest.
itemptr	Pointer field in a record that specifies the location within a block of ASCII code where the text to a particular question is located. (See page A-29 for diagram.)
key pad	Seventeen-key keyboard used by the examinee to interact with the CAT programs.
krunch	Pascal command to eliminate empty space on a graphic screen.
LOGON	A program to gain access to the Corvus hard disk.
PARAMS	Abbreviation of the word "parameters," used as a variable in the program.
pixel	One of the "dots" that make up the graphics screen. The number of pixels per screen vary with the mode.
QTEXT	Directory of files that contains the text of questions used by the CAT program.
ret	Return.
SPSSfile	A file of examinee test scores written at the completion of the testing session. It is called "SPSS" because it will be subjected to statistical analyses, although not necessarily those of the Statistical Package for Social Sciences (1983).
STOPFLAGS	Variable name used in the Test Parameter Configuration program. If set to "yes" for a particular subtest, the testing sequence will be halted after the flagged subtest is completed.
text file	File that stores information such as computer programs, letters, and text.
Theta	The ability level scale used in the implementation of a Bayesian strategy (Owen, 1975) for administering questions. There are 36 levels, beginning with -2.25 and stepping up in increments of +.125 to +2.125.
Thunderclock	Trademark for a clock made by Thunderware, Inc., and used by the Apple computer to track item response time.

APPENDIX A

CAT SYSTEM DOCUMENTATION

Section 1--Features A-1
Section 2--Requirements and Volume Contents A-6
Section 3--Program Descriptions A-11
Section 4--System Structure A-17
Section 5--File Structure A-25

SECTION 1
FEATURES

Minimal Requirements for a CAT System

According to Dewitt and Weiss (1974), the minimal requirement for any CAT system is the ability to perform the following functions:

1. Select a test item from an item pool following a predetermined set of instructions.
2. Present the item on a cathode ray tube or other display unit.
3. Accept a response.
4. Check response for validity and compatibility with the instructional sequence.
5. Determine whether the response is correct or incorrect.
6. Calculate the response latency (time required to answer the question).
7. Save the obtained data.
8. Select the next item to be administered in accordance with a specified testing strategy.

The NAVPERSRANDCEN CAT System, Initial Version [1.01]

In addition to the minimum requirements as described by Dewitt and Weiss (1974), the NAVPERSRANDCEN CAT system provides the following features :

1. The system can be configured to give up to 20 subtests in any order, with any strategy, provided appropriate data structures exist for a particular strategy and subtest.
2. The system is self-instructional and friendly. Examinees are presented with a computer familiarization session which they must pass according to a specified criterion. If they cannot, the proctor is automatically called. Subtest instructions and sample questions are given if they exist in the data base.
3. Each subtest can be configured to give up to 20 questions. Also, each subtest has a flag that can be set to call the proctor at the conclusion of the subtest. Each subtest has a minimum variance that can be set to terminate the subtest when the examinee's variance matches or is less than this value.
4. The system keeps track of how much time the examinee has spent in the computer familiarization sequence, in subtest instructions and samples, on each subtest, and in the entire session. It also counts the proctor calls during a subtest and for the entire session.
5. Examinees are allowed to change their answer at the time each question is presented. At this point, they also have the option of calling the proctor by pressing the <HELP> key.

6. Feedback (scoring results) can be provided to examinees at three levels: (a) after a question, (b) after a subtest, and (c) at the end of the session.

7. Proctor options allow the examinee to continue with the session, exit the session and resume testing later, skip certain procedures, or terminate the current subtest and begin the next subtest in the sequence. An examinee who is in the middle of a subtest and desires to leave the session must answer the current question before the session will terminate. Upon return, the examinee will resume at the same point. If a subtest is terminated to go on to the next one, it is officially over and cannot be resumed.

8. Minimal data loss occurs upon power failure or other disaster. Power loss to the system will result in all examinees losing data for the current subtest. When power is restored, examinees must log in again, whereopon they will begin the subtest that was in progress when the power failed. Files are updated at the conclusion of each subtest.

9. A demonstration mode is provided. When the log in routines ask for the ID number, typing the word "demo" and then pressing the <YES> key will put the system in the demonstration mode. No data will be written to the disk, and session feedback cannot be given.

10. A self-test mode is provided. Typing the word "ghost" for the ID number will put the system in the self-test mode. The system will run indefinitely, taking subtests and answering questions without any keyboard input. No data will be written to disk.

11. A trace mode is provided. Typing the word "trace" for the ID number will put the system in the trace mode. Then all system trace messages put in by the programmer will appear.

12. Data are stored in Pascal data files. They are readily interpretable and easily accessible. At the end of an examinee's session, data are written out to a text file for analysis by SPSS (1983).

13. Up to 21 item pools can be created. Each item pool is a subtest that may contain a bank of 295 questions and 5 sample questions. All items in the subtest, instructions, samples, and questions are readily displayed, modified, entered, or deleted. Data can be modified. Questions may be presented as graphics.

14. Test data banks can be listed to screen, file, or printer for verification. Text and data, or data only can be listed as output.

15. System security is provided. Examinees cannot log into the system unless the proctor has given prior authorization.

16. New strategies can easily be integrated into the system. The program is modular and minimal modifications are necessary.

17. Graphics capability is provided. A graphics editor allows creation of graphics questions.

18. Examinee data-base management is provided by a program that allows one to look at, enter, modify, or delete examinee records.

19. Flexibility of test administration is provided. The testing parameters file is easily modified through a program to give various configurations.

20. Strategy data-base management is provided to allow viewing, entering, and modifying of data in strategy data structures and to identify the questions actually used in the strategy.

21. Overall system friendliness is provided by simple menus and instructional prompting given by the computer.

Changes Introduced in the Second Version [1.02]

1. On the last screen shown to an examinee in a speeded test, times are set to zero for unfinished items in the examinee's file.

2. System log-in by the proctor in Examinee Data Base Management allows multiple examinee log-ins without return to the main menu.

3. Routines are added to analyze the item sequencing specified by the "infotable" (see glossary). For example, by listing the items that are used in the table and those that are not, items that will never be used in the current strategy may be identified. This kind of analysis helps the system designer eliminate unused items from the pool.

4. Additional elements are added to the examinee personal data record. Verification of certain data is required when the examinee resumes interrupted testing. While the old data structure was restricted to Navy school codes and formats, the new data structure allows for testing Marines and members of the other armed services. Test Administration now asks for correct date before sessions are given; this information is saved in the examinee files.

5. The Apple III computer has a type-ahead buffer, which could allow examinees to type the answers to questions before they are presented. The NAVPERSRANDCEN CAT system includes a keyboard flush-ahead to prevent examinees from doing so. The keyboard flush-ahead is disabled for timed tests to allow examinees to answer questions on a multiple-question screen before the entire screen has appeared. Thus, the examinees can respond at their maximum speed, without waiting for the computer.

6. The first version of the CAT keyboard included an "erase" key to allow examinees to edit their responses to free-response items. However, free-response tests were never used. The new version of CAT removes explanation and practice in the use of the erase key from the Test Administration's computer familiarization.

7. The limits for times tests are modified to allow specification of both minutes and seconds.

8. To reduce the likelihood of examinees receiving the same initial sequence of items, items are selected at random from a pool of the best items. Three randomization strategies are available:

a. The (5 4 3 2 1) strategy selects at random the first item from the best five, the second item from the best unused four, and so forth.

b. The (10 8 6 4 2) strategy selects the first item at random from the best ten, and the fifth to last items at random from the best two unused items.

c. The (10 2 2 2 2) strategy selects the second to last items at random from the best two unused items (see section 3).

Changes Introduced in the Third Version [1.03]

1. New system diagnostic procedures are added. The program will check infotables to verify that items in the infotable are actually in the item pool and that no items are marked as used at the beginning of a test. It will check all subtest questions to see that if the graphics flag is set, there is a graphics file on the volume: it will also check a subtest for duplicate or similar questions.

2. Graphics compresssion is implemented. Most files of graphic screen images have been reduced from 32 blocks to 4. Compressed files that require less than 5 seconds to be displayed replace the 32-block "fotofiles" (see glossary). The graphics editor has been revised to allow for compression and is more friendly, displaying a menu of options.

3. Documentation of the CAT system is available on line to users on their Apple III monitors. A CAT system with the documentation files requires a 20-megabyte disk drive.

Changes Introduced in the Fourth Version [1.04]

1. A routine is added that checks the infotable for duplicate entries. This routine is incorporated into the verify option of the Infotable Manager program. If a duplicate is found, an error message will appear along with the duplicated infotable locations.

2. The program will delay writing an examinee's test results to the hard disk until a proctor has entered a password and continued the program. This will prevent damage to files due to simultaneous writing to the same disk file by several examinees.

Changes Introduced in the Fifth Version [1.05]

1. The Ghost self-test routine has been modified to simulate a predesignated ability level. There are now three options available: an idiot ghost that randomly guesses on all items (the original Ghost routine), a specified ability-level ghost, and a program loop ghost that exercises ability levels -3.0 through +3.0 by stepping up in intervals of +1 with each completion of a test session.

2. For each examinee, predicted scores are calculated that estimate the scores the examinee would have received on a paper-and-pencil ASVAB test. This information is included in the examinee test results file. The predicted ASVAB score is calculated for only five subtests: word knowledge, mechanical comprehension, paragraph comprehension, general science, and arithmetic reasoning.

SECTION 2
REQUIREMENTS AND VOLUME CONTENTS [1.05]

This section describes the hardware and software required to use the CAT system version [1.05], including the Apple III computer, Corvus system, and the contents of the Corvus volumes.

Apple III

CAT system [1.05] is designed to run on an Apple III microcomputer with data access to a Corvus hard disk (model 11AP) having at least 10 megabytes of storage. The Apple III must have at least 256 K bytes of memory available and be equipped with a THUNDERCLOCK PLUS (see glossary). The monitor for the computer must be capable of 40- and 80-column displays.

Corvus

The Corvus disk storage unit can be linked to as many as eight Apple III computers by a Corvus multiplexer. Backups of the CAT program can be made using a feature of the Corvus system called the Mirror. The Mirror program copies the contents of specified Corvus volumes to a videotape. The current implementation of the CAT program uses a separate videotape recorder for creating backups.

The Corvus disk must have a minimum of 10 megabytes of storage, configured in the following way:

1. Volumes necessary for the CAT system are :

   a. "CS1." This volume contains the necessary Pascal operating system code files.

   b. "CATDATA." This volume contains the code files of the CAT system and all data bases, for the subtests, examinees, configuration files, and strategy data.

   c. "QTEXT." This volume contains the text of all questions in the CAT system.

   d. "CATFOTO." This volume contains all the graphic questions in subdirectories.

   e. "TFILES." This volume contains all the program text files for the CAT system.

2. Volumes a through d must be mounted for access on the Corvus in order to execute the CAT system.

3. All volumes are Apple III SOS formatted.

4. The contents of the Corvus volumes b through e are described on the following pages.

Volume : CATDATA Size : 4504 Blocks

File	Description
CATPIC.FOTO	Session header introduction
TESTINDEX.DATA	Subtest directories
PARAMETERS.DATA	Subtests configuration file
TABINFO.DATA	Infotables for Bayesian strategy
ITEMPOOL.DATA	Subtest data, parameters, flags, pointers
EINDEX.DATA	Examinee data base directory
EPDATA.DATA	Examinee personal data
EINFO.DATA	Examinee testing data (not test results)
ERESULTS.DATA	Examinee testing results
DONERSLTS.DATA	Done examinee testing results
DONEEPD.DATA	Done examinee personal data
DONEDIR.DATA	Done examinee data base directory
DONEINFO.DATA	Done examinee testing data (not test results)
CATDATE.DATA	Data file that contains current CAT date
CATPROJECT.CODE	CAT system driver code file
ADMIN.CODE	Test administration code file
P.MGR.CODE	Parameters configuration code file
T.MGR.CODE	Test data base management code file
E.MGR.CODE	Examinee data base management code file
S.MGR.CODE	Strategy data base management code file
G.MGR.CODE	Graphics management code file
D.MGR.CODE	Cat system diagnostic program code file

Volume : QTEXT Size : 2048 Blocks

File	Description
ITEMTEXT.DATA	Text for all questions in data base

Volume : CATFOTO Size : 10880 Blocks

This volume contains subdirectories for each subtest in the data base. All fotofiles for a subtest are saved in a designated subdirectory. Programs will automatically decide where to save or load a fotofile and automatically give it a designated file name.

File	Description	Subtest
ADIR	Subdirectories of	Word Knowledge
BDIR	fotofiles and	General Science
CDIR	compressed	Arithmetic Reasoning
DDIR	graphics.	Math Knowledge
EDIR	"	Paragraph Comprehension
FDIR	"	Numerical Operations
GDIR	"	PC2
HDIR	"	Auto Information
IDIR	"	Mechanical Comprehension
JDIR	"	Electronic Information
KDIR	"	Coding Speed II
LDIR	"	Numerical Operations II
MDIR	"	Numerical Operations III
NDIR	"	Numerical Operations IV
ODIR	"	Coding Speed III
PDIR	"	Coding Speed IV
QDIR	"	MK2
RDIR	"	Shop Information
SDIR	"	MC2
TDIR	"	AR2
UDIR	"	EI2

Volume : TFILES Size : 2048 Blocks

All text files for the CAT project are located on this volume.

File	Description
CATPROJECT.TEXT	CAT system driver textfile
ADMIN.DIR	Subdirectory--test administration text files
ADMIN.TEXT	Test administration driver
A.DEC.TEXT	Declarations for test administration
A.1UTL.TEXT	Utilities
A.2UTL.TEXT	Utilities

A.ESUMM.TEXT	Write examinee data to text file at end of session
A.IO.TEXT	I/O routines
A.PROCT.TEXT	Proctor routine
A.CF.TEXT	Computer familiarization
A.LOGIN	Log in examinee
A.GI.TEXT	General instructions
A.INITE.TEXT	Initialize examinee subtest record before test
A.LOADT.TEXT	Load a subtest to administer
A.QUEST.TEXT	Select a question to administer
A.UABIL.TEXT	Update the examinee's ability and variance
A.FBACK.TEXT	Give feedback to the examinee
PMGR.DIR	Subdirectory--parameter management text files
P.MGR.TEXT	Driver to set up system parameters
P.UTL.TEXT	Utilities
P.VIEW.TEXT	Look at testing parameters
P.SP.TEXT	Configure testing parameters
P.FBACK.TEXT	Configure feedback parameters
TMGR.DIR	Subdirectory--test manager text files
T.MGR.TEXT	Test manager driver
T.1UTL.TEXT	Utilities
T.SUBRT.TEXT	Utilities--subroutines
T.1SUBRT.TEXT	Utilities--subroutines
T.IO.TEXT	I/O routines
T.GET1.TEXT	Fetch subtest part 1
T.GET2.TEXT	Fetch subtest part 2
T.INSTR.TEXT	Manage subtest instructions
T.SAMPLES.TEXT	Manage sample questions for subtest
T.LIST.TEXT	List subtests in data base
T.NEW.TEXT	Create a new subtest
T.DELETE.TEXT	Delete a subtest
T.FLOPPY.TEXT	Write subtest to floppy
T.SEARCH.TEXT	Search for duplicate questions
EMGR.DIR	Subdirectory--examinee manager text files
E.MGR.TEXT	Examinee manager driver
E.UTL.TEXT	Utilities
E.SUBRT.TEXT	Utilities--subroutines
E.IO.TEXT	I/O routines
E.LOGIN.TEXT	Log in examinees, allow access to system
E.FETCH.TEXT	Get examinee to put in personal data
E.STATUS.TEXT	Display status of all examinees in system
E.DELETE.TEXT	Delete an examinee from data base
E.ENDOFDAY.TEXT	Separate completed examinees
E.SUMMARY.TEXT	Write examinee data to text file for SPSS
E.ZERO.TEXT	Zero out examinee data base

SMGR.DIR	Subdirectory--strategy manager text files
S.MGR.TEXT	Strategy manager driver
S.UTL.TEXT	Utilities
S.NEW.TEXT	Make new infotable
S.VERF.TEXT	Verify infotable
S.MODF.TEXT	Modify infotable
S.LIST.TEXT	List infotable
S.FIND.TEXT	Queries into infotable
S.ANALYZE.TEXT	Analysis on infotable values
GMGR.DIR	Subdirectory--graphics management
G.MGR.TEXT	Graphics editor driver
G.UTL.TEXT	Utilities
G.SUBRT.TEXT	Main menu graphics procedures
G.1SUBRT.TEXT	Compression routines to krunch graphics
G.2SUBRT.TEXT	More compression routines
DMGR.DIR	Subdirectory--CAT diagnostic program
D.MGR.TEXT	Diagnostic driver
D.UTL.TEXT	Utilities
D.SEARCH.TEXT	Searches a subtest for duplicate questions
D.INFOTAB.TEXT	Checks validity of infotables.
D.GRAFIX.TEXT	Checks to see whether graphics files exist
UMGR.DIR	Subdirectory--user documentation text files
U.MGR.TEXT	User documentation driver
MISC.DIR	Subdirectory--miscellaneous text files
CATFFORMAT.TEXT	Formats new files for system
CATKRUNCH.TEXT	Will krunch the question text file

Volume : DOC Size : 2048 Blocks

This volume contains the documentation text files that are accessed by the User Documentation program.

SECTION 3
PROGRAM DESCRIPTIONS

Seven programs make up the CAT system. These programs, which are all related through the files they access, are as follows:

Test Administration

This program gives the examinees a computer orientation sequence and then administers a sequence of subtests as specified by a control file. Questions are selected by adaptive testing strategies (Owen, 1975) and data on examinee sessions are recorded and saved. The main modules of the program are :

1. Proctor routines.
2. Computer familiarization.
3. General instructions.
4. Log in procedures.
5. Examinee pretest initialization.
6. Loading subtest and strategy.
7. Administering a question.
8. Updating the examinee ability level.
9. Feedback routines.

The program basically controls the flow of execution through these modules. Files are updated after every subtest, so that if power loss or some interruption occurs, causing the system to crash, all examinees will be able to log on again and resume the subtest they were on at the beginning. The following three major loops in the program exist:

1. Giving continuous sessions.
2. Giving a sequence of subtests.
3. Giving a sequence of questions.

Configure Test Parameters

The Configure Test Parameters program allows the testing parameters to be set up. This program is run at the beginning of the testing day, and it does the following :

1. Allows any combination of subtests, up to 20 from a pool of 21.
2. Allows the selected subtests to be given in any order.

3. Allows 1 to 20 questions to be given per subtest.
4. Allows any subtest to be given with any available strategy if a strategy data structure exists for the subtest.
5. Allows each subtest to have a lower limit on the variance of the estimated ability. The subtest will automatically terminate when this lower limit is reached.
6. Allows temporary delay after each subtest, if needed. This delay halts the session until the proctor starts up the examinee again.
7. Allows examinee feedback parameters to be specified. A detailed or simple summary can be displayed or printed using question, subtest, or session feedback.
8. Allows for verification of the system parameters by writing the data to a printer or screen.

A file contains all the information necessary to accomplish these functions. Whenever a change is made in the parameters, the file is updated.

Current infotable strategies include :

B102222: Randomly selects from the 10 best questions in a specified row for the first question, and randomly from the next 2 best questions for every question thereafter.

B54321: For question 1, randomly selects from 5 best questions; for question 2, randomly selects from 4 best questions; for question 3, selects from 3 best questions; for question 2, selects 2 best questions; and for every question thereafter, selects the best question for a specific row.

B108642: For question 1, randomly selects from 10 best questions; for question 2, randomly selects from 8 best questions; for question 3, randomly selects from 6 best questions; for question 4, randomly selects from 4 best questions; and for every question thereafter, selects the 2 best questions for a specific row.

Test Manager

The CAT Test Manager program maintains a data base of up to 21 subtests and their respective item pools. The program can do the following :

1. Create a new subtest if there is room, and then insert questions into that subtest.
2. List all the subtests in the main directory to see which subtests exist and how many questions are in each one.

3. Remove a subtest from the data base.

4. Change the name of any subtest, and specify whether the subtest requires a 40 or 80 column format, using the first character of the subtest name. The second character of the name can be used to specify the cutoff time, in minutes, of a timed subtest. The third and fourth character are used to specify the seconds.

5. Transfer a subtest from the Corvus files onto a floppy disk for moving data. A recovery program is needed to restore the original format to use the floppy data with the Test Administration Program.

6. Access a subtest for any of the following reasons :

a. To insert a question, its text, code number, and associated data.

b. To delete a question from the subtest.

c. To insert, modify, delete, or look at the instructions for the subtest.

d. To insert, modify, delete, or look at up to five subtest sample questions for the subtest.

e. To modify the text, code number, or any data associated with a question.

f. To set a graphics flag that signals that the item has a graphics picture associated with it, normal or compressed.

The program accomplishes all these functions through a hierarchical structure of options and the use of three files: (1) the tests directory, which contains all subtests and their respective directories, (2) the file that contains all the data for each question of any subtest, and (3) the file that contains ASCII and special program codes to display question text. These three files are used by the CAT Test Administration program to display questions and use question data for strategy algorithms.

Special Programming Notes

1. Slot 0 of a subtest directory is reserved for the subtest instructions. If the code number for this slot is greater than or equal to 0, then the subtest instructions exist.

2. Slots 1 to 5 of a subtest directory are reserved for the subtest sample questions. If the code number in any of these slots is greater than or equal to zero, then the sample question exists in that slot.

3. Various types of answers are stored, due to the different types of subtests. The program can store the correct answer to a question as a character, an integer, or an array of seven characters.

4. The first character of the subtest name specifies the screen format for that subtest. '*' sets the screen to 80 columns inverse, '@' sets the screen to 80 columns normal, and '?' sets the screen to 40 columns normal. If none of

these are the first character of the subtest name, then the screen will default to 40 columns inverse. The second, third, and fourth characters of the subtest name are used to specify the allotted time for speeded tests. The second character is used to specify minutes, while the third and fourth are used for seconds.

Examinee Data Manager

The CAT Examinee Data Manager maintains and provides access to a data base of up to 50 examinees. The following functions are described:

1. "ENTER EXAMINEE PERSONAL DATA" allows proctors to enter changes, or look at the examinee personal data.

2. "VIEW EXAMINEE RECORDS" displays to the screen, printer, or file a brief summary of the examinee performance on the subtests, as well as the time spent in each subtest and for the entire session.

3. "REMOVE EXAMINEE" removes an examinee from the directory in the data base.

4. "PURGE DIRECTORY" clears out and initializes the entire directory to empty (no examinees in system).

5. "LOG EXAMINEE INTO SYSTEM" allocates file space for an examinee and, by doing so, allows the examinee to take the subtests in the Test Administration program. No examinee can take subtests without first being entered into the system through this procedure. When the examinee logs into the Test Administration program, his or her ID number is checked to see if it exists in the system. If it does, the examinee can continue.

6. "SEPARATE DONE/NOT DONE EXAMINEES" searches through the files for all examinees who have completed their testing sessions and writes these examinees out to a separate file. This file has an identical record format, so that any procedure to access the original file can also access the "finished" examinees. It also writes a summary of each examinee to a text file on the volume CATDATA, with the following file name: "E," concatenated with the examinee's social security number.

7. "SELECT FILES TO MANAGE" sets the file needed, either the files in which examinees' names are originally entered (session files), or the files that also contain the names of the finished examinees (done-examinee files).

8. "LIST DIRECTORY" lists the status of the examinees in the directory whether they are new, finished or partially completed with the subtests.

Strategy Data Manager

The CAT Strategy Data Manager program provides maintenance and access to the data structures necessary for computerized adaptive testing. Its basic functions are to provide a means for entering data into the data

structures, modifying the data in the data, and listing the data to the console, a printer, or a file for verification. Data structures are maintained as information tables using a matrix of 36 rows by 20 columns.

Graphics Editor

This program allows you to construct graphics for the subtest questions that require them. Sixteen K of memory must be allocated for graphics to run this program. After you specify the subtest you wish to work with, you are put into the graphics editor with the following options:

F)ast cursor:	Sets flag to move pixel cursor to eight times as fast.
S)low cursor:	Sets pixel cursor to normal speed.
D)raw:	Sets flag so keypad numbers will plot points.
E)rase:	Sets flag so keypad numbers will erase points.
K)runch:	Will compress whatever is on the graphics screen to a data file of points and lines.
C)haracters:	Enters character mode. Any key pressed will be displayed on the screen. Press <ESCAPE> to leave this mode.
L)ine:	Draws a line between last plotted point and current position.
Q)uit:	Exits editor and returns to main menu.
H)ome:	Positions cursor at the lower left-hand side of drawing screen.
R)ead:	Reads and loads a graphics picture (fotofile or compressed graphics). A four-digit item code or specifed name is requested.
P)olygon:	Draws a polygon. The number of sides and the size are requested. Enter even integer numbers for sides.
N)ew:	Clears entire viewport.
W)rite:	Saves whatever is displayed on the screen. Writes it to a file. A four-digit item code or specified file name is required.

<up arrow>:	Moves position up one pixel.
<down arrow>:	Moves position down one pixel.
left arrow>:	Moves position left one pixel.
1..9:	Pressing these keys on the numeric keypad will plot a point or erase a point in these respective directions : 1,SW; 2,S; 3,SE; 4,W; 5 current position, 6,E; 7,NW; 8,N; 9,NE.

Diagnostic Program

This program allows you to verify system stability by checking infotables, graphic questions, and subtest questions. The following options are available :

CHECK INFOTABLES: This procedure loads the infotable for each subtest and checks each item code entry to see whether it exists in the subtest directory. If not, the location where the error occurred is saved and the errors listed. For the timed tests, or where no infotable is necessary, the error count will normally be 760 errors.

CHECK GRAPHICS: This procedure checks each question for each subtest. If the graphics or compressed graphics flag is set, then the procedure will attempt to locate the appropriate file on the volume CATFOTO in the appropriate subdirectory. If it cannot locate the file, then it records the item code and lists the errors.

DUPLICATE QUESTION SEARCHES: This procedure takes two pieces of information supplied by the user and searches a subtest for duplicate questions. The user supplies the number of keywords, up to 20, that will be taken from a question to be matched. The user also supplies a minimum criterion; that is, the minimum number of matches that will be acceptable to identify the two questions as similar. The minimum criterion can be up to 20 words. The user does not enter the actual words, but the number of words to be compared. The program searches the text of a specified subtest and gets the specified number of the longest words in the question. It then compares these words with other words of other questions. If the minimum criterion number of words match, then it records that question pair as similar. Output is a list of similar questions.

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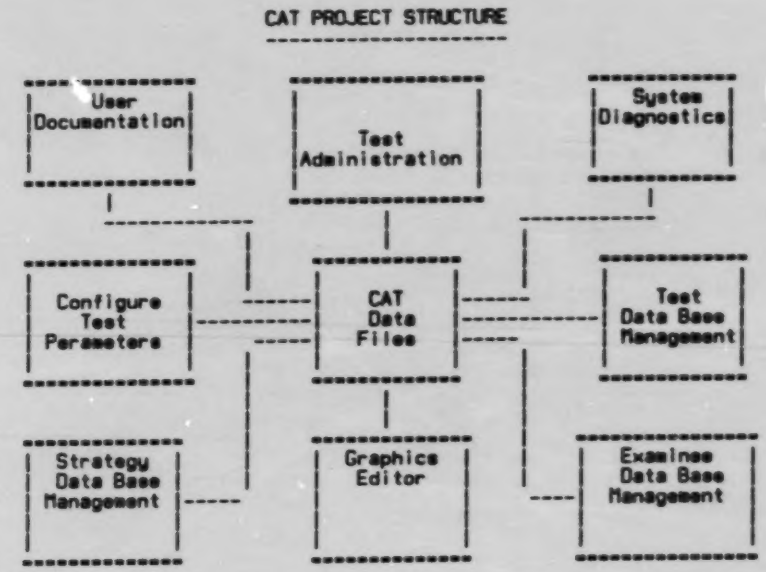
SECTION 4
SYSTEM STRUCTURE

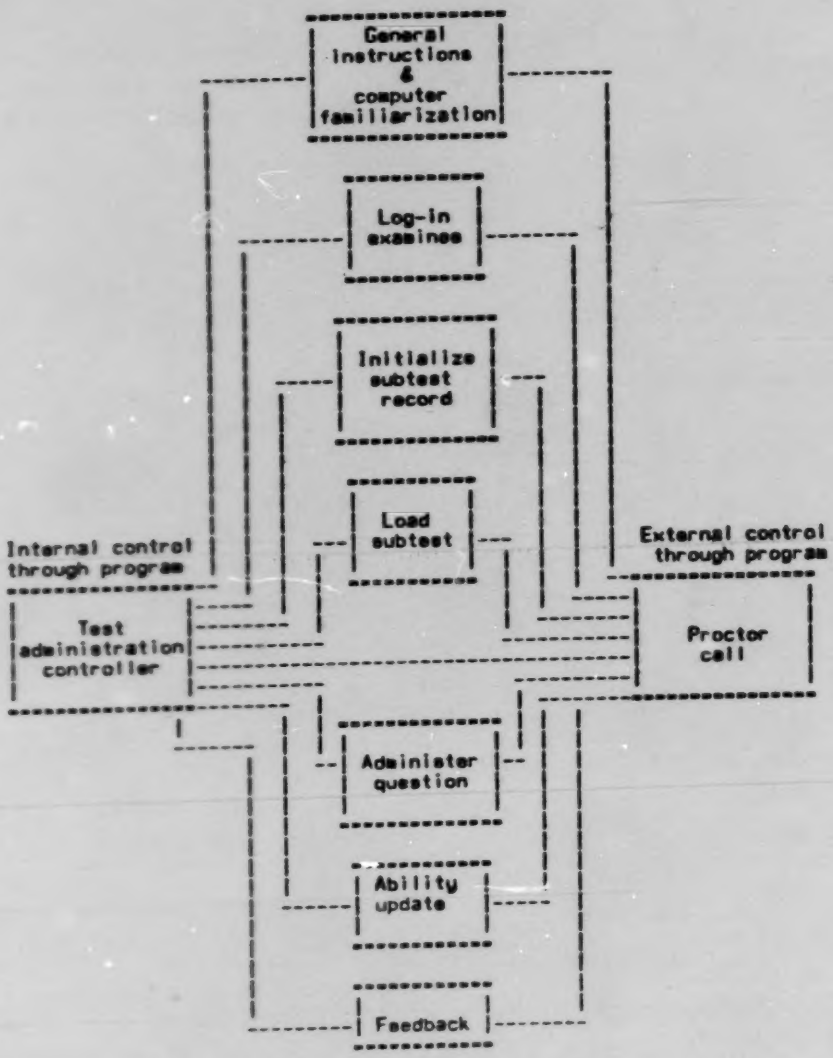
The CAT system structure is divided into seven primary programs and a supplementry user documentation program, each with special characteristics that are noted below and described in more detail in Appendix B, sections 2 through 9). The programs access a common data base of "CAT Data Files." The following diagram shows how the programs fit together:



Test Administration (ADMIN)

This is the prototype schema for administering a sequence of subtests to each examinee, based on adaptive strategies, and then saving the results. the following figures illustrate the Test Administration program structures.

TEST ADMINISTRATION STRUCTURE



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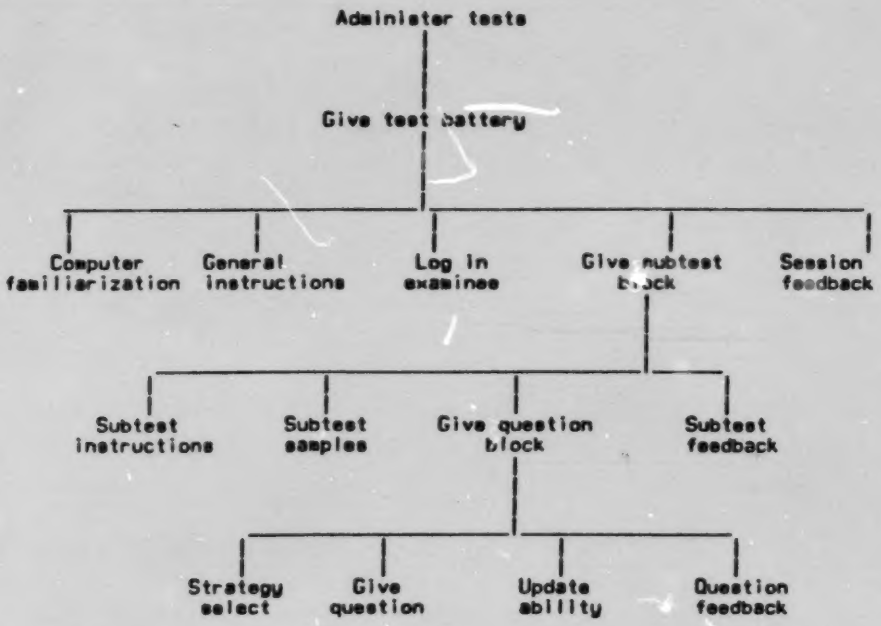
TEST ADMINISTRATION HIERARCHY



CAT Test Administration Modules

Controller (ADMIN). This module reads in the test configuration vectors and controls the flow through all the modules. It calls general instructions, logs in examinees, gives sessions of subtests, and provides feedback.

General Instructions (A.CF & A.GI). This module familiarizes the examinee with the computer keyboard and gives general instructions on how to take the tests.

Log In Examinee (A.LOGIN). This module gets examinee personal data and verifies entry to the system. It sets flags and counters to handle new or returning examinees.

Initialize Examinee (A.INITE). This module sets up an examinee test results record to handle new and returning examinees. It also restores configuration vectors assigned to specific examinees.

Load Subtest (A.LOADT). This module loads the subtest directory of items and the strategy data structure. It gives subtest instructions and samples.

Administer Question (A.QUEST). This module selects a question based on strategy and examinee ability level (if required), displays the question, gets examinee response, and updates the results record. It will never give the same question twice to an examinee. It also selects the two alternative items to administer next: the one the examinee will receive for answering correctly, and the other for answering incorrectly.

Feedback (A.FBACK). This module sends feedback on a question, subtest, or session level to the console or printer.

Update Ability (A.UABIL). This module takes the examinee's current ability estimate and the new ability estimate and its variance, using the A, B, and C parameters of the question last answered.

Proctor Call (A.PROCT). This module provides external control through the other modules. The proctor is called by the examinee when the computer senses keying errors or when the examinee presses the <HELP> key. The proctor can then allow the examinee to continue

Configure Test Parameters (P.MGR)

This program allows users to change the default test configuration vectors. It allows tailoring of subtest strategies, order, length, and so on.

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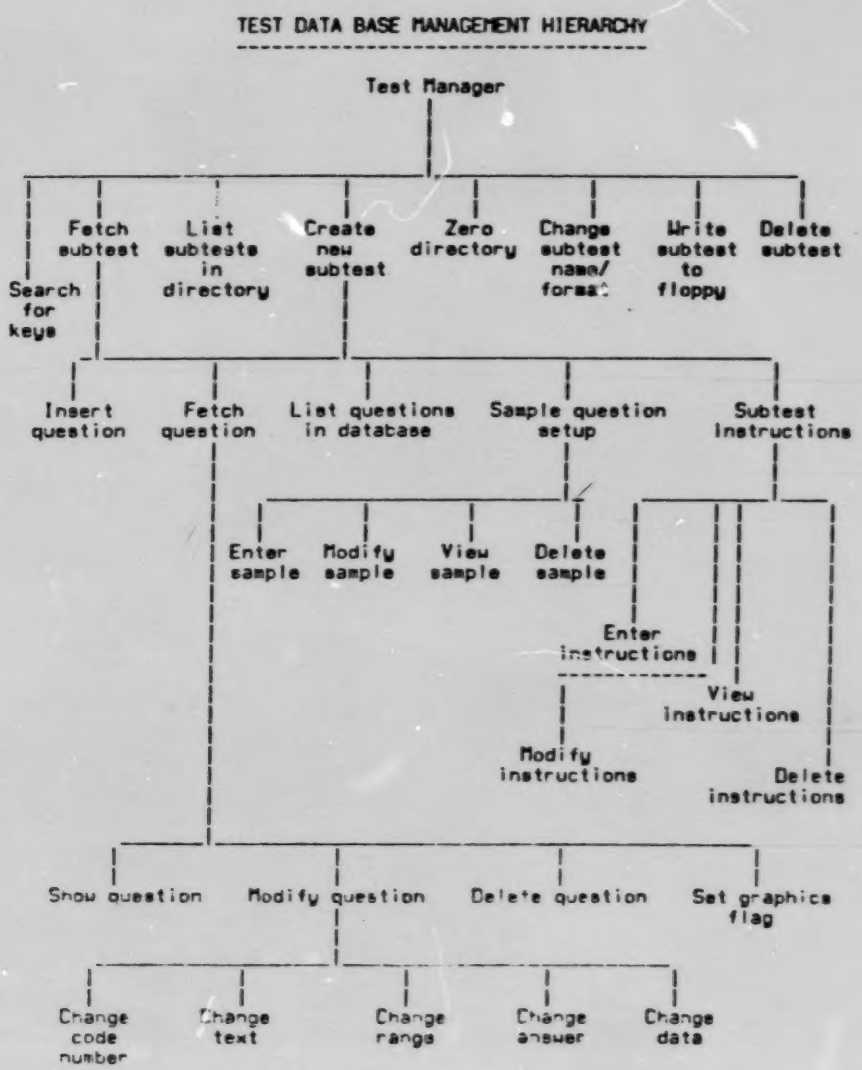
Test Data Base Management (TMGR)

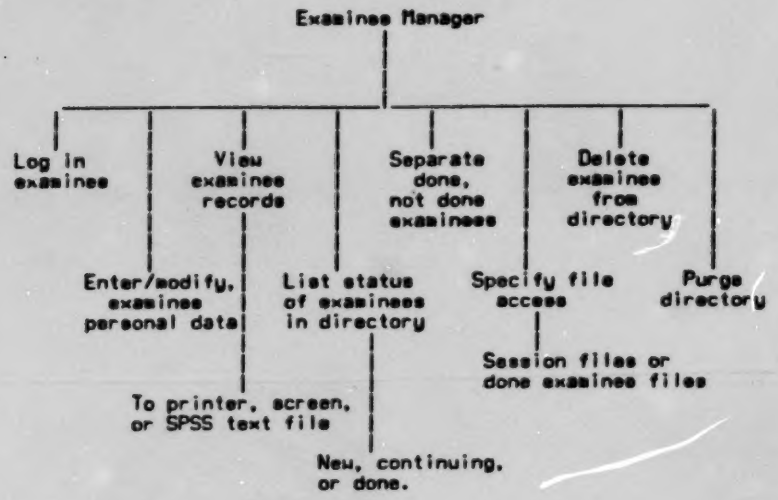
This program manages the data base of subtests and their respective item pools. It allows creation of new subtests, insertion of items, and editing for text and data.



Examinee Data Base Management (E.MGR)

This program allows access to all parts of the examinee data, the personal data, and test results. It permits statistical and psychological interpretation of data.

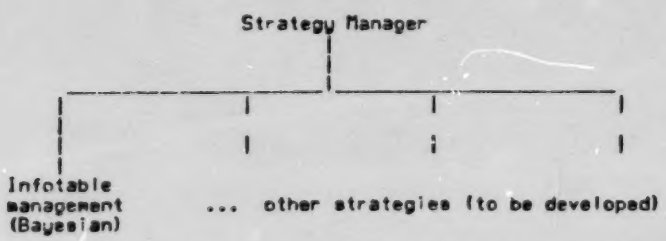
EXAMINEE DATA BASE HIERARCHY


Examinee Manager
Log in examinee
View examinee records
Separate done, not done examinees
Delete examinee from directory
Enter/modify, examinee personal data
List status of examinees in directory
Specify file access
Purge directory
Session files or done examinee files
To printer, screen, or SPSS text file
New, continuing, or done.

Strategy Data Base Management (S.MGR)

Many strategies involve data structures that define the selection of questions. This program permits manipulation and management of the data.

STRATEGY DATA BASE MANAGEMENT HIERARCHY



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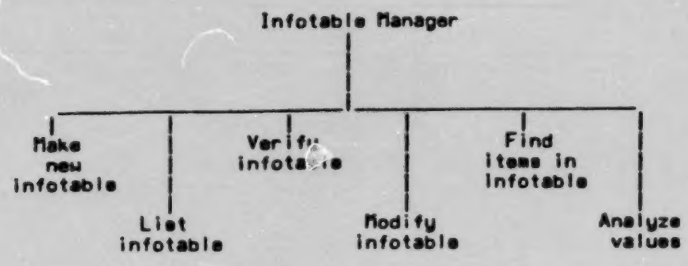
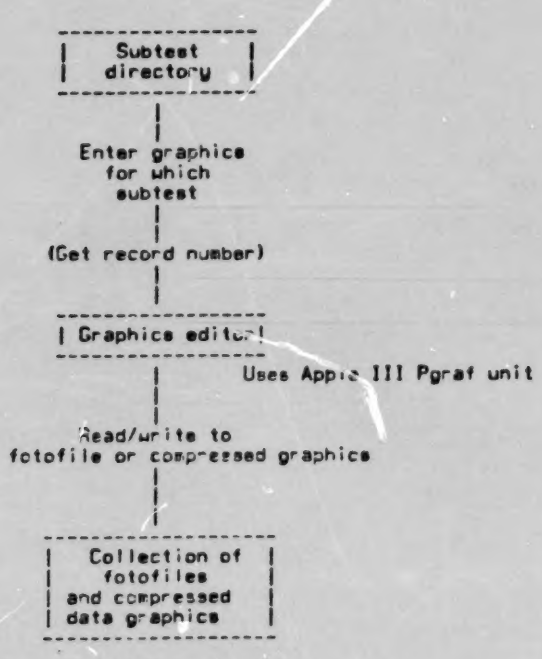
INFOTABLE MANAGER HIERARCHY



Graphics Editor (G.MGR)

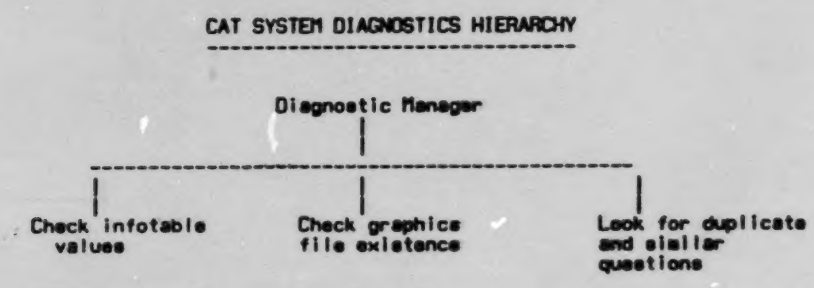
This program allows creation and modification of pictures for items that require them. Graphics are stored as fotofiles or as compressed data files.

GRAPHICS EDITOR STRUCTURE


Subtest directory
Enter graphics for which subtest
(Get record number)
Graphics editor
Uses Apple III Pgraf unit
Read/write to fotofile or compressed graphics
Collection of fotofiles and compressed data graphics

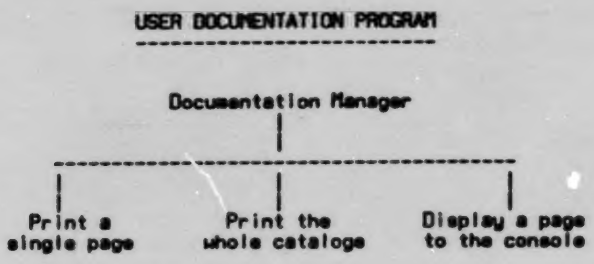
CAT System Diagnostics (D.MGR)

This program checks the validity of data in certain files; namely, the infotables, graphics, and ASCII text.



User Documentation (U.MGR)

This program provides the user with access to documentation text files that are kept on the Corvus disk.



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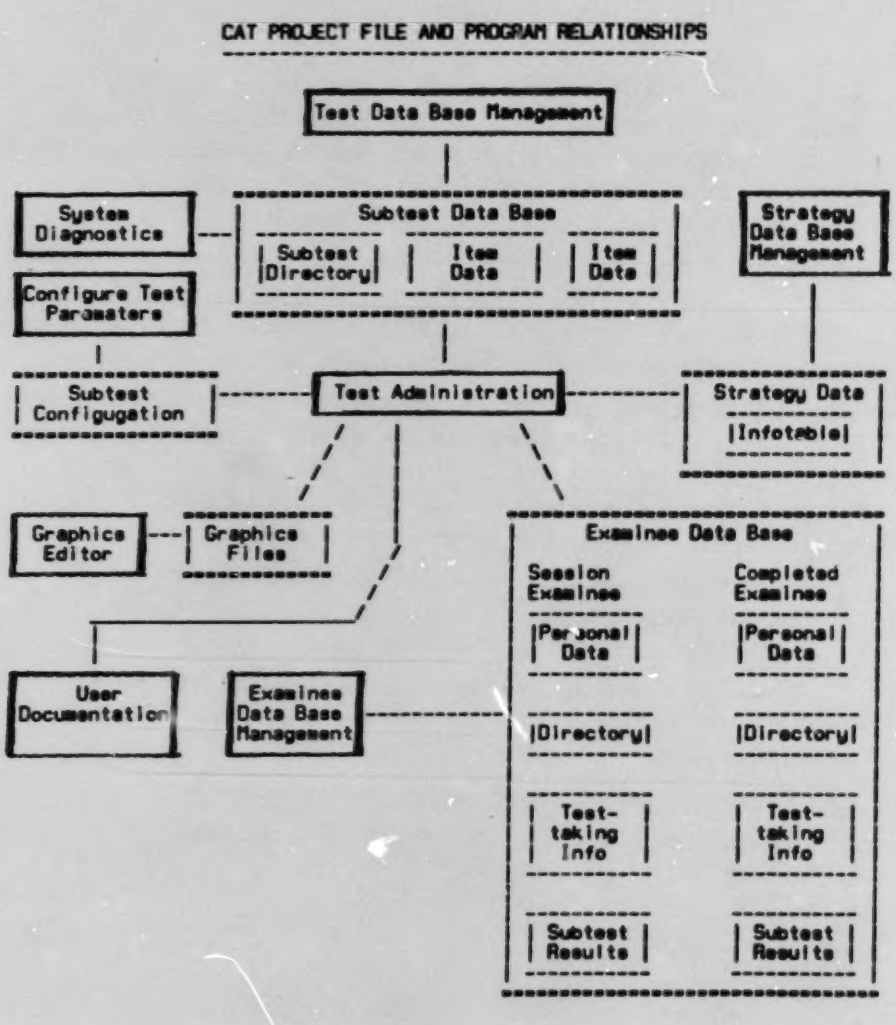
SECTION 5
FILE STRUCTURE

This section outlines the five file structures used in the CAT system – subtest data base, subtest configuration, examinee data base, strategy data, and graphics files. The structures will be detailed in the following pages. The diagram below shows how the structures relate to the program discussed in the previous section.



Note. Files are designated by double outlines; programs by bold lines.

Subtest Data Base

The subtest data base uses three file structures in the following manner :

1. The directory file contains records of subtest directories. The subtest directory record contains a linear list of item codes for that test. The location of the item code in the list is used as a key in a mapping function that specifies the location of the question data in the second file. A field for the subtest name is checked for the desired subtest directory. The first slot in the linear list of item codes is reserved for subtest instructions. Slots 1 through 5 are reserved for sample questions. Through the subtest name, the screen parameters are specified (i.e., inverse/40 columns). If it is a timed subtest, three digits in the subtest name specify the cut-off time in minutes and seconds.

2. The item data file contains records that store all data and parameters for each item. Two important fields are the itemblock and itemptr. These pointers specify the location of the question text in the third file. Itemblock specifies the block in which the text begins and itemptr specifies the location within the block, the byte at which the question begins.

3. The item text file contains nothing but ASCII codes, byte counts, and other codes necessary for manipulating the question text. The first four bytes are reserved for pointers to the end of the file so that text for new items or modifications may be inserted there. Special codes are :

128: This flag signals the occurrence of a gotoxy cursor movement. When this code is read, the program identifies the next two bytes as the x-coordinate and y-coordinates to move to. The next byte after the x and y bytes is a count of the number of characters on this particular line. This enables mass movement of bytes to write the line out to the screen.

129: This flag signals that the question continues on another screen image, thus allowing the program to prompt the user to press a key to continue reading the question.

130: This flag marks unused space in the ASCII file when a question is deleted or changed. The old text is marked as unused for possible garbage collection later.

131: This flag marks the end of the text for this item.

Layouts of the records contained in these three files are provided on pages A-27 through A-29.

Layout of Subtest Directory File

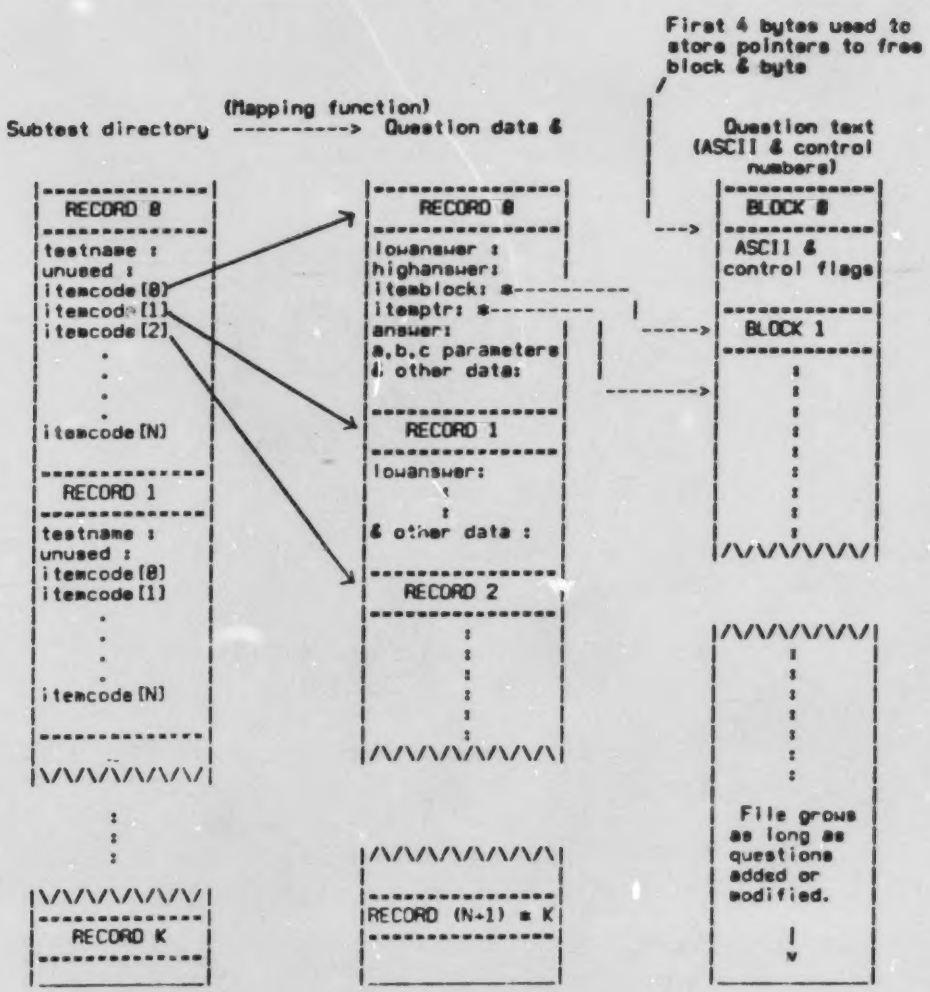
```
(* test directory *)
DIRDATA = PACKED RECORD
                (* true ==>  this record not occupied *)
                UNUSED    : BOOLEAN;

                (* name of subtest *)
                TESTNAME  : STRING;

                (* directory of pool of questions in subtest *)
                ITEMCODE  : PACKED ARRAY
                            [0..MAXITEMPOOL]
                            OF INTEGER; (* question code # *)
        END;
```

Layout of Item Data File

```
(* question ptrs/data , information for each question *)
ITEMDATA = PACKED RECORD
                (* flags if graphics item *)
                GRAPHICS : BOOLEAN;

                (* valid response ranges for multiple choice *)
                LOWANSWER,
                HIGHANSWER : CHAR;

                (* block # in file where text starts *)
                ITEMBLOCK,

                (* byte # in block where text starts *)
                ITEMPTR,

                (* # of answers if multiple question screen *)
                ANSWERCOUNT  : INTEGER;

                (* information parameters for bayesian strategy *)
                A,B,C,

                (* currently unused *)
                PROPCORRECT,
                POINTBISERIAL,
                YOPT,
                XOPT,
                DUMMY1, (* if compressed graphics, = 1.0 *)
                DUMMY2,
```

```
    DUMMY3 : REAL;

    (* correct answer to question *)
    CASE ATYPE : ITEMRESPONSES OF
          CHARVALUE : (ANSWER : CHAR);
          INTVALUE  : (INTANSWER : INTEGER);
          SEVENCHR  : (CHRANSWER : SEVENTYPE);
END;
```

FILE STRUCTURE : SUBTEST DATA BASE



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Layout of Item Text File

Block 0

free block #		free byte #							
/	\	/	\						
167	1	2	0	128	0	4	15	111	102
116	121	32	109	111	115	116	32	110	101
97	114	108	121	32	109	101	97	110	115
58	128	6	7	26	46	32	32	104	105
103	104	128	6	9	58	46	32	32	104
97	121	108	105	107	101	128	6	11	51
46	32	32	115	111	102	116	128	6	13
52	46	32	32	108	101	118	101	108	131
128	0	4	65	117	116	111	110	111	109
121	32	109	111	115	116	32	110	101	97
114	108	121	32	109	101	97	110	115	58
128	6	7	49	46	32	32	115	101	108
102	45	103	111	118	101	114	110	109	101
110	116	128	6	9	58	46	32	32	112
97	114	108	105	109	101	110	116	128	6
11	51	46	32	32	99	111	110	115	116
105	116	117	116	105	111	110	128	6	13
52	46	32	32	104	105	115	116	111	114
121	131	128	0	4	67	108	117	116	99
104	101	100	32	109	111	115	116	32	110
101	97	114	108	121	32	109	101	97	110
115	58	128	6	7	49	46	32	32	108
111	111	115	101	110	101	100	128	6	9
58	46	32	32	103	114	97	115	112	101
100	128	6	11	51	46	32	32	115	104
111	118	101	100	128	6	13	52	46	32
32	115	116	111	112	112	101	100	131	138
138	138	138	138	131	128	0	4	77	111
117	114	110	32	109	111	115	116	32	110
101	97	114	108	121	32	109	101	97	110
115	58	128	6	7	49	46	32	32	115
117	110	117	112	128	6	9	58	46	32
32	108	97	121	98	114	101	97	107	128
6	11	51	46	32	32	103	114	105	101
118	101	128	6	13	52	46	32	32	115
117	115	112	101	99	116	131	128	0	4
77	97	103	110	105	102	121	32	109	111
115	116	32	110	101	97	114	108	121	32
109	101	97	110	115	58	128	6	7	49
46	32	32	108	105	109	105	110	105	115
104	128	6	9	58	46	32	32	101	128
97	103	103	101	114	97	116	101	128	6
11	51	46	32	32	114	101	102	108	101
99	116	128	6	13	52	46	32	32	114

end of text flag = 131

gotoxy flag = 128

x location,
y location, &
byte count are the
3 consecutive bytes
after gotoxy flag

unused = 138

ascii = 32 .. 126

Subtest Configuration

The subtest configuration file contains the default configuration vectors for test administration. This file contains information on feedback parameters, appropriate strategies, appropriate length for subtests, and choice of subtests to give. It is set up by a configuration program:

```
record_0
Record contains
all of the
items listed at
the left
```

```
(* set-up parameters *)
SETUPINFO = PACKED RECORD
(* flags # tests in sequence, > 20 = no subtest *)

SUBORDER,

(* strategy setup *)
SUBSTRAT : PACKED ARRAY[1..GMAXSUBTEST]
OF 0..128;

(* question feedback code *)
ITEMFB,

(* question feedback output code *)
ITEMOUTPUT,

(* subtest feedback code *)
SUBTESTFB,

(* subtest feedback destination code *)
SUBTESTOUTPUT,

(* session feedback code *)
SESSIONFB,

(* session feedback destination; screen/printer *)
SESSIONOUTPUT : 0..128;

(* subtest stop flag *)
SUBSTOP : PACKED ARRAY[1..GMAXSUBTEST]
OF BOOLEAN;

(* subtest length *)
SUBLENGTH : PACKED ARRAY[1..GMAXSUBTEST]
OF 0..128;
```

```
                (* variance check *)
                CKERROR : ARRAY[1..GMAXSUBTEST] OF REAL;

        END;
```

Examinee Data Base

The data base for the examinee records includes four types of files: examinee personal data, directory, test-taking information, and subtest results. Two sets of these files exist: (1) the "session" files that are updated as examinees are taking the test, (2) identical files that contain information only for completed examinees. When the procedure for separating completed examinees from the others is run in E.MGR, the session files are searched. Any examinees who have completed their session are removed from the session files and transferred to the "done" files.

1. The personal data file contains information such as the examinee's name, address, social security number, state, and marital status.

2. The examinee directory is a linear list of an identification key and a flag indicating that the slot in the directory is occupied. A search for an examinee consists of stepping through the directory looking for the matching ID key. The slot in which it was found specifies the record number of the second file in which personal data are found and is also used as a key in a simple hash function to return the number of the examinee's first subtest results record. The next 19 records are the 2nd through 20th subtest results. For example, any examinee who was located in directory slot 4 would have personal records in record 4 of the personal data file and test results in records (4 * 20) = 80 through 99 of the subtest results file. The hash function consists of simply multiplying the slot number by 20.

3. The test-taking information file contains records of the test configuration vectors assigned to each examinee, the length of time the examinee spent in the session, the time he or she spent in computer orientation, and other test-related data.

4. The subtest results file accommodates a maximum of 20 subtests with a maximum of 20 questions per test. Relevant data stored include the number of questions taken, number correct, response, ability, variance, time latency, and so on. Layouts of examinee data base records are presented below.

Layout of Personal Data Record

```
(* examinee personal data *)
PINFOREC = RECORD
                LASTNAME : PACKED ARRAY[0..14] OF CHAR;
                FIRSTNAME : PACKED ARRAY[0..11] OF CHAR;
```

```
            MINITIAL : CHAR;
            CURRADDRESS,
            HOMEOFREC  : PACKED ARRAY[0..1] OF CHAR;
            CITIZENSHIP : PACKED ARRAY[0..3] OF CHAR;
            SEX : CHAR;
            POPGROUP : PACKED ARRAY[0..4] OF CHAR;
            ETHNIC : PACKED ARRAY[0..1] OF CHAR;
            MARITAL : CHAR;
            DEPENDANTS : PACKED ARRAY[0..1] OF CHAR;
            BIRTHDATE : PACKED ARRAY[0..7] OF CHAR;
            EDUCATION : PACKED ARRAY[0..2] OF CHAR;
            TESTID : PACKED ARRAY[0..2] OF CHAR;
            AFQT : PACKED ARRAY[0..1] OF CHAR;
            ASVAB  : PACKED ARRAY[0..43] OF CHAR;
            ENLISTDATE,
            ACTSERDATE  : PACKED ARRAY[0..7] OF CHAR;
            ENL : PACKED ARRAY[0..4] OF CHAR;
            AFEES : PACKED ARRAY[0..1] OF CHAR;
            BOS : PACKED ARRAY[0..1] OF CHAR;
            POSTASVAB : PACKED ARRAY[0..43] OF CHAR;
            STESTORDER : PACKED ARRAY[0..59] OF CHAR;
        END;
```

Layout of Directory Record

```
(* examinee directory *)
INDEX = PACKED ARRAY[0..MAXEXAMINEE]
            OF PACKED RECORD
                    (* true ==> record available *)
                    UNUSED : BOOLEAN;

                    (* social security/id key *)
                    ID : IDTYPE;
        END;
```

Layout of Test-taking Information Record

```
(* examinee test taking data *)
EXAMEINFO = PACKED RECORD
            (* social security # *)
            ID : IDTYPE;
```

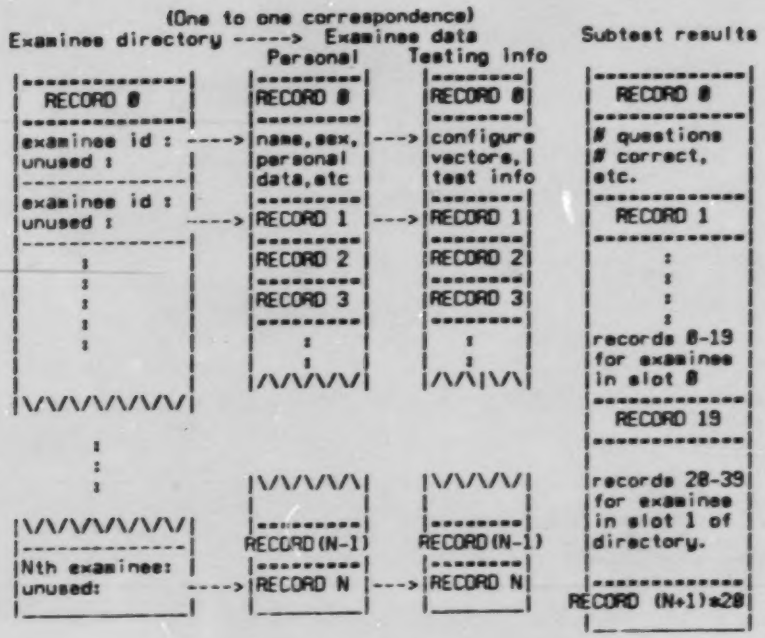
```
    (* time spent in computer orientation *)
    ORIENTATIONTIME,

    (* timed test, last time session was interrupted *)
    PREVTIMELASTTEST,

    (* number of proctor calls *)
    NUMPROC,

    (* total time spent at computer *)
    TOTTIMECONSOLE,

    (* number of key in errors *)
    NUMERRORS,

    (* # of last test taken - 1, eg.- if on test 5 *)
    (* then this variable holds a value of 4.*)
    LASTTEST : INTEGER;

    (* date of log in *)
    DATE : PACKED ARRAY[0..5] OF CHAR;

    (* time at log in *)
    TIME : PACKED ARRAY[0..3] OF CHAR;

    (* testing configuration given to this examinee *)
    (* record # of subtest directories *)
    TESTORDER,

    (* adaptive strategy *)
    STRATEGY,

    (* # of questions per test *)
    TESTLENGTH : PACKED ARRAY[1..GMAXSUBTEST]
                    OF 0..128;

    (* predicted asvab scores paper/pencil test *)
    PREDASVAB,

    (* initial variance for each test *)
    CKERROR : ARRAY[1..GMAXSUBTEST] OF REAL;

    (* flags to control flow of subtests *)
    SUBSTOP : PACKED ARRAY[1..GMAXSUBTEST] OF BOOLEAN;
END;
```

Layout of Subtest Results Record

```
(* question scores , data on examinee with respect to question *)
ITEM = PACKED RECORD
            (* keeps track of correct answers for multiple question *)
            (* screens.                                            *)
            ACORRECT : PACKED ARRAY[0..6] OF BOOLEAN;

            (* number of questions per screen *)
            ACOUNT,

            (* which question he took, code # *)
            ITEMNUM  : INTEGER;

            (* true ==> answered it correctly *)
            CORRECT  : BOOLEAN;

            (* ability after answering this question *)
            THETA,

            (* variance after answering this question *)
            ERROR,

            (* time spent answering this question *)
            LATENCY  : REAL;

            (* how he answered the question *)
            CASE RTYPE : ITEMRESPONSES OF
                CHARVALUE : (RESPONSE : CHAR);
                INTVALUE  : (INTRESPONSE : INTEGER);
                SEVENCHR  : (CHRRESPONSE : SEVENTYPE);
      END;



(* test scores of examinee results  *)
SUBTEST = PACKED RECORD

            (* time in seconds taken for subtest *)
            STTIME,

            (* number of seconds spent in subtest instructions *)
            STINSTRTIME,

            (* number of proctor calls during subtest *)
```

```
STPROCTCALLS,

(* number of keying errors during subtest *)
STERRKEY     : INTEGER;

(* number of questions he answered *)
NUMITEMS,

(* # of correct responses *)
NUMCORR  : 0..128;

(* final estimate of ability *)
ESTABILITY,

(* final variance of ability *)
VARIANCE    : REAL;

(* results on question level *)
ITEMINFO    : PACKED ARRAY[0..QUESTIONS] OF ITEM;
END;
```

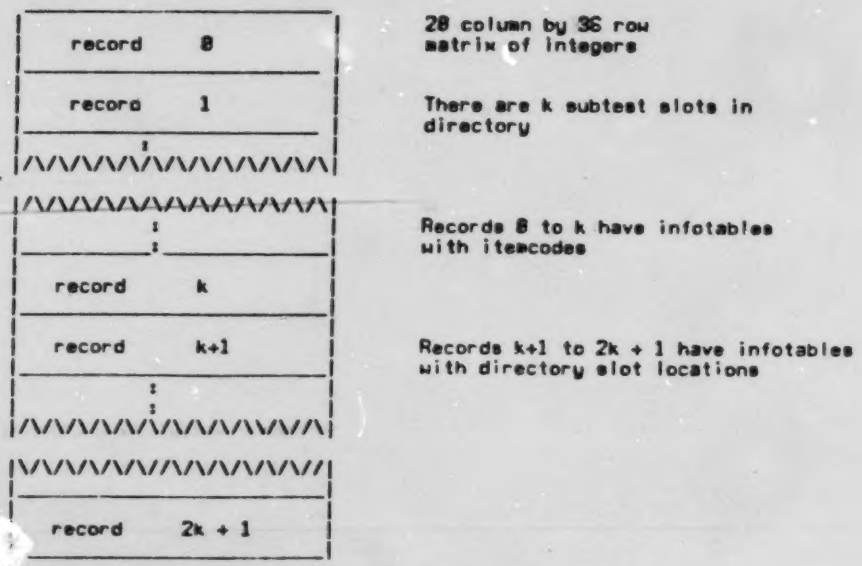
FILE STRUCTURE : EXAMINEE DATA BASE



Strategy Data

An "infotable" is a table of item numbers sorted by information for each of a number of ability levels. The CAT system currently uses infotables with 36 rows of ability levels and 20 columns of items. The ability levels vary from -2.250 to +2.125 in steps of 0.125 on the theta scale. For example, the 10th row in the infotable corresponds to an ability of -1.250. The first column contains the item ID number of the item with the greatest information for that ability level, the second column contains the number of the item with the second greatest information for that ability, and so forth.

The data file record is declared as a matrix of 20 columns by 36 rows of integers (array[1..20,1..36]). Each record contains one table, and tables are loaded into a program variable. The program knows which table to load because there is a one-to-one correspondence of the number of the infotables and the number of subtests allowed in the directory. If a test is loaded from directory record 0, then record 0 in the infotable file contains the infotable for that subtest. The infotable is not loaded from that record, however, because there are two infotables for each subtest. Infotables in records 0 through N contain the item code number as an entry in the table, while records N+1 through 2N+1 contain the directory index for the item. The second set of records are set up whenever an infotable is verified in the infotable manager. This is the record that the Test Administration program uses because it has directions about the location of the item and does not need to search the directory.


record 0
record 1
record k
record k+1
record 2k + 1
20 column by 36 row matrix of integers
There are k subtest slots in directory
Records 0 to k have infotables with itemcodes
Records k+1 to 2k + 1 have infotables with directory slot locations

BEST COPY AVAILABLE

INFOTABLE MAPPING OF ABILITY TO ROW

Row	Range (ability)	Midpoint
1	-2.31250 .. -2.18751	-2.25000
2	-2.18750 .. -2.06251	-2.12500
3	-2.06250 .. -1.93751	-2.00000
4	-1.93750 .. -1.81251	-1.87500
5	-1.81250 .. -1.68751	-1.75000
6	-1.68750 .. -1.56251	-1.62500
7	-1.56250 .. -1.43751	-1.50000
8	-1.43750 .. -1.31251	-1.37500
9	-1.31250 .. -1.18751	-1.25000
10	-1.18750 .. -1.06251	-1.12500
11	-1.06250 .. -0.93751	-1.00000
12	-0.93750 .. -0.81251	-0.87500
13	-0.81250 .. -0.68751	-0.75000
14	-0.68750 .. -0.56251	-0.62500
15	-0.56250 .. -0.43751	-0.50000
16	-0.43750 .. -0.31251	-0.37500
17	-0.31250 .. -0.18751	-0.25000
18	-0.18750 .. -0.06251	-0.12500
19	-0.06250 .. 0.06249	0.0
20	0.06250 .. 0.18749	0.12500
21	0.18750 .. 0.31249	0.25000
22	0.31250 .. 0.43749	0.37500
23	0.43750 .. 0.56249	0.50000
24	0.56250 .. 0.68749	0.62500
25	0.68750 .. 0.81249	0.75000
26	0.81250 .. 0.93749	0.87500
27	0.93750 .. 1.06249	1.00000
28	1.06250 .. 1.18749	1.12500
29	1.18750 .. 1.31249	1.25000
30	1.31250 .. 1.43749	1.37500
31	1.43750 .. 1.56249	1.50000
32	1.56250 .. 1.68749	1.62500
33	1.68750 .. 1.81249	1.75000
34	1.81250 .. 1.93749	1.87500
35	1.93750 .. 2.06249	2.00000
36	2.06250 .. 2.18749	2.12500

Graphics Files

The Graphics Manager saves the screen image with a built-in procedure in the Pgraf unit. Each screen image occupies 32 blocks of disk storage, called a "fotofile." The user does not have to specify the filename, which is computed by the following method:

Fotofile name is the letter "G" concatenated with the character of the ASCII value 65 + the subtest record number (this yields a character from A - Z), concatenated with the letter "Q," concatenated with the item code number, concatenated with ".foto."

Example: If the subtest occupies record 2, and the item code is 1103, then the fotofile name is GBQ1103.foto. The "G" stands for graphics, the "B" designates the subtest, "Q" stands for question, 1103 designates the question, and ".foto" designates a graphics screen image. The fotofile name is written out to a subdirectory on volume CATFOTO, based on the graphics code and subtest record number.

Compressed Graphics Structure

The graphics compression program is designed to run on the Apple III with 16K of memory allocated for graphics. The mode of graphics is black and white, 560 by 192 pixels. The procedure allows users to compress the standard 32-block fotofile into data files using considerably less space. A procedure to decode these compressed files confirms the state of the compressed picture and compares the display time with that used by the Pgraf routine GLOAD. The data file is unformatted. Information is read from it in increments of four blocks into a buffer of type integers or bytes. The file names for the compressed graphics are calculated in the same way as fotofiles, except that "Q" is not used for question. File names are written out to the appropriate subdirectory in a similar way.

Graphics Compression Algorithm

1. The contents of the graphics screen are read into two array buffers. Buffer 1 always reflects the state of the original screen. Buffer 2 reflects what is left to compress after each phase of compression.

2. Compression occurs in five phases: Buffer 1 is first scanned in the X-direction, Buffer 1 is scanned in the Y-direction, Buffer 2 is scanned in the ascending and descending diagonal directions, and Buffer 2 is scanned for any remaining dots. Finally, ASCII codes are added to the file for characters. These phases are described in further detail below:

Phase 1: Buffer 1 is scanned in a horizontal fashion searching for lines greater than one pixel length. If a line is found, the following information is saved : X location, Y location, and a line length. Buffer 2 is updated to reflect what has been compressed.

Phase 2: Buffer 1 is scanned in a vertical fashion searching for lines greater than one pixel length. If a line is found, the two buffers are compared to find any dots already set by Phase 1. The beginning and end of the line are adjusted if the extreme ends have been previously set. Then the dots internal to the line are checked. The ratio of dots previously compressed to those not compressed are checked. The line will be compressed if the ratio meets a certain value. Otherwise, the line will be compressed in the later phases. The ratio is currently biased toward drawing lines. The information saved is: X location, Y location, and a line length. Buffer 2 is updated.

Phase 3: Buffer 2 is scanned to search for diagonal lines. If a diagonal line greater than length 2 is found, then the following information is saved: x location 1, X location 2, Y location 2. Buffer 2 is updated.

Phase 4: Buffer 2 is scanned for any remaining dots, and the X location and Y location are saved.

Phase 5: The user enters characters into the graphics picture, and these characters are saved in a buffer representing the screen. Then they are written out to the same file as the graphics data, with the information in length of bytes. The ASCII values are written out similarly to the data for normal text questions (See subtest file structures for more details).

Compressed Graphics Display Algorithm

1. Display of a compressed graphics picture also occurs in five phases. Four blocks from the compressed data file are read into a buffer, and information is extracted sequentially through it.

Phase 1: This phase draws horizontal lines. X - location, Y - location, and a line length (dot count) are expected. A MOVETO(X,Y) is executed, followed by a LINEREL (linelength,Y). Data are continually fetched until the X location is negative, which signals the end of Phase 1.

Phase 2: This phase draws vertical lines. x - location, Y - location, and a line length (dot count) are expected. A MOVETO(X,Y) is executed, and followed by a LINEREL (X,linelength). Data are fetched again and the instructions executed until the X - location is negative, signaling the end of Phase 2.

Phase 3: This phase draws diagonal lines. X1 - location, Y1 - location, X2 - location, and Y2 - location are extracted. A MOVETO(X1,Y1) is performed, followed by LINETO(X2,Y2). Data are fetched again and the instructions executed until the X - location is negative, signaling the end of Phase 3.

Phase 4: This phase draws dots, extracting the X - location, and Y - location. A DOTAT(X,Y) is performed, data are fetched again, and the instructions executed until the X - location is negative. This point signals the end of Phase 4 and the graphics decoding of the compressed picture.

Phase 5: The ASCII characters are written out to the graphics screen.

A goto flag moves the cursor to the appropriate location, and then the ASCII are written byte by byte. An end-of-text flag (131) signals the end of the file. At this point the complete picture is displayed.

GRAPHIC FILES OVERVIEW

SUBTEST	GRAPHICS CODE	SUBDIRECTORY	RECORD NUMBER
Word Knowledge	A	ADIR	0
General Science	B	BDIR	1
Arithmetic Reasoning	C	CDIR	2
Mathematics Knowledge	D	DDIR	3
Paragraph Comprehension	E	EDIR	4
Numerical Operations	F	FDIR	5
PC2	G	GDIR	6
Automotive Information	H	HDIR	7
Mechanical Comprehension	I	IDIR	8
Electronics Information	J	JDIR	9
Coding Speed II	K	KDIR	10
Numerical Operations II	L	LDIR	11
Numerical Operations III	M	MDIR	12
Numerical Operations IV	N	NDIR	13
Coding Speed III	O	ODIR	14
Coding Speed IV	P	PDIR	15
MK2	Q	QDIR	16
Shop Information	R	RDIR	17
MC2	S	SDIR	18
AR2	T	TDIR	19
EI2	U	UDIR	20

APPENDIX B

CAT USER DOCUMENTATION

Section 1--Bringing up the CAT System B-1
Section 2--Test Administration Program B-3
Section 3--Configure Test Parameters Program B-8
Section 4--Test Data Base Management Program B-16
Section 5--Examinee Data Base Management Program B-36
Section 6--Strategy Data Base Management Program B-41
Section 7--Graphics Editor Program B-56
Section 8--System Diagnostics Program B-63
Section 9--User Documentation Program B-67
Section 10--Graphics Information B-74
Section 11--Miscellaneous Associated Programs B-80

This manual assumes that the user has some knowledge of the Corvus system, such as how to boot and mount volumes. It also assumes the user has some knowledge of the Pascal operation system, such as how to execute Pascal code files.

SECTION 1
BRINGING UP THE CAT SYSTEM

In order to use the CAT system, the three volumes listed below must be mounted on the Apple III's disk system (usually a Corvus 10 megabyte hard disk). These three volumes contain the necessary code and data files.

CATDATA: Program code files and data files to access the various subtests and their questions and datafiles for results of testing; 4000 blocks minimum.

CATFOTO: Graphic questions with 32 blocks per question for foto, 4 blocks for compressed graphics.

QTEXT: Text for questions; size depends on the questions in the subtests. Typically up to 600 blocks or more.

The Apple III computer must have 256K of RAM, a clock, and 16K of memory allocated for the graphics buffer. Begin by executing the following program: "/CATDATA/CATPROJECT.CODE"

This code file manages all of the major parts in the CAT system. The following menu will appear:

CAT PROJECT MENU [1.05]

Select one of the following programs by entering its number.

1. QUIT
2. TEST ADMINISTRATION
3. CONFIGURE TEST PARAMETERS
4. TEST DATABASE MANAGEMENT
5. EXAMINEE DATABASE MANAGEMENT
6. STRATEGY DATABASE MANAGEMENT
7. GRAPHICS EDITOR
8. CAT SYSTEM DIAGNOSTICS
9. ON-LINE USER DOCUMENTATION

Enter choice # :

Each of the numbered items constitutes a separate code file. Access a program by typing its number from the menu or by executing the code file directly from the Pascal command line.

Each of these code files is on the volume CATDATA. The code file names corresponding to each program are:

TEST ADMINISTRATION	ADMIN.CODE
CONFIGURE TEST PARAMETERS	P.MGR.CODE
TEST DATABASE MANAGEMENT	T.MGR.CODE
EXAMINEE DATABASE MANAGEMENT	E.MGR.CODE
STRATEGY DATATBASE MANAGEMENT	S.MGR.CODE
GRAPHICS EDITOR	G.MGR.CODE
CAT SYSTEM DIAGNOSTICS	D.MGR.CODE
ON-LINE USER DOCMENTATION	U.MGR.CODE

The programs are described in sections 2 through 9.

SECTION 2
TEST ADMINISTRATION PROGRAM
(MENU OPTION 2)

Test Administration requires a test proctor first to check that certain requirements are fulfilled. Then the examinee is guided through a familiarization sequence and expected to enter a social security number to log on to the system. The examinee is then given a series of subtests, and the results are saved automatically on disk.

There are four important things to check before running the Test Administration program:

1. Make sure enough file space is allocated to cover the examinees to be tested, using the Examinee Data Base Management program (see section 5).

2. Testing parameters should be checked for the proper subtest sequence and appropriate strategies, using the Configure Test Parameter program (see section 3).

3. Feedback parameters must be checked to be certain that the Apples are interfaced correctly with the printer (see section 3).

4. The alpha-lock key on the Apple must be pressed down so that all keys are entered as capitals.

To begin administering the program, execute '/ CATDATA/CAT-PROJECT.CODE'. The menu screen will be displayed. Choose option 2 (Test Administration) from the menu. The program will return with the date. If a change is desired, the year, month, and day must all be changed, or else the date will appear with the unkeyed portions deleted.

```
CAT SYSTEM DATE IS  3 / 31 / 83

DO YOU WISH TO CHANGE THE DATE ?

PRESS <YES> OR <NO> :
```

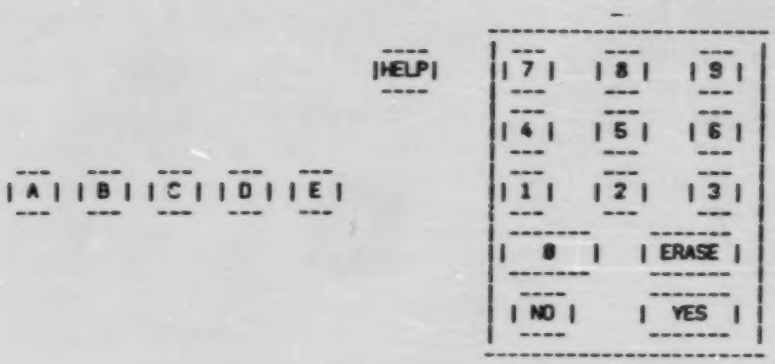
Once the date is set correctly and <NO> is pressed, the screen will display the CAT logo. Pressing the <YES> key now will begin the test

session.

The examinee will be guided through a series of computer familiarization and general instruction screens. This segment gives the examinee a little time to become acquainted with the keyboard.

The entire Test Administration sequence is designed to be self-teaching, requiring little supervision for the examinees. The following documention describes actions for any unusual problems that may interrupt the sequence of testing.

KEYBOARD CONFIGURATION



The alphabetic and numeric keys on the keyboard are used for answering the subtest questions. The <YES> and <NO> keys confirm the examinee response and allow a second chance to answer. The <ERASE> key allows the examinee to change a key entry, while the <HELP> key will call the proctor.

While the program guides the examinee through the familiarization module, it will restate a question that is answered incorrectly. If the examinee makes more than three keying errors during any practice exercise, or if the <HELP> key is pressed, the proctor will be called. At this point the screen will display the message, PLEASE CALL THE PROCTOR, and will not respond further until a special password is entered.

To continue the program and bring up the proctor menu, press the <YES> key to clear the buffer of any keys that the examinee may have pressed. Then :

1. Enter the password "CAD" if using a modified keyboard, or "LJ;" if using the normal keyboard. Press the <YES> key.

The program should prompt the user with: "PASSWORD :". If this does not appear, make sure the alpha-lock key is pressed, and then repeat step one.

2. Now enter the password "C1" if using the modified keyboard, or "L1" if using the normal keyboard. A proctor menu should be displayed on the screen. If not, repeat step two of the password sequence. The procter menu display will vary depending on the module the call was made from. There are six possible options for the proctor menu. Since it is impractical to illustrate each menu, the options will be described below:

1. RETURN TO TESTING PROCEDURES. Allows the examinee to continue with the Test Administration program as if the proctor had never been called.

2. EXIT GENERAL INSTRUCTIONS. Allows the examinee to skip the rest of the familiarization sequence and continue to the general instructions. If the examinee is in the general instructions sequence, then the program will allow a branch to the log-on routine.

3. EXIT LOGON/CONTINUE. If this option is chosen before the examinee has entered a social security number, the session will terminate for the examinee and a new session will begin.

4. EXIT SUBTEST INSTRUCTIONS/SAMPLES. This option allows the examinee to skip the subtest instructions and go on to the subtest sample questions, or skip the samples and go on to the actual testing.

5. GO ON TO NEXT SUBTEST. Allows the examinee to leave the current subtest and go on to the next one. The examinee cannot go back to the subtest from which the proctor was called.

6. GO ON TO NEXT SESSION. Allows the examinee to leave the session and return to testing at some later time. If the present question has not been completed, the examinee must give an answer. When the examinee returns to the session, he or she will be returned to the same subtest left and resume testing as if no interruption had occurred. The subtest time and the total session time may be altered or incorrect. Instructions and samples are repeated.

A proctor menu screen is displayed after a proctor call from the computer familiarization and general instruction module. An example of a proctor menu screen follows:

PROCTOR MENU

Set one of the following options by
entering its number, then pressing the
<YES> key.

1. RETURN TO TESTING PROCEDURES
2. EXIT GENERAL INSTRUCTIONS
3. GO ON TO NEXT SESSION

Enter choice #, then press <YES> :

Special Options

There are four options that the user may find helpful for running the program:

1. Entering the word "ghost" in the social security number prompt screen will call a procedure that inserts random numbers to the test questions and will run the program until stopped by a <CONTROL> <RESET>.

2. By entering the word "demo" when an examinee's social security number is requested, the user will prevent all data for the session from being written to the disk. At the end of a demonstration session, the program is returned to the normal mode.

3. A third option allows the user to bypass the keyboard familiarization sequence and branch directly to the testing procedures. This is done by pressing the <ESCAPE> key instead of <7> on the initial familiarization screen prompt.

4. In most modules of the program, the user can exit the procedure by pressing the <ESCAPE> key.

If an examinee successfully completes a full session, a compressed image of the results and personal data is written to a text file in the volume QTEXT. Each file name begins with an "E" followed by the examinee social security number and ends with the word "Text."

Handling System Failures

In the event of power loss or something else that causes the computer to reboot, a minimal data loss will occur. After every subtest, the Corvus disk is updated; thus, in the event of a system failure, the user simply reboots and runs the program as normal. After logging on, the examinee is returned to the beginning of the subtest being taken when the system failure occurred.

System Fatal or Near-Fatal Error Messages

1. "Block read io error # ..". This message indicates that the computer tried to read a nonexistent block trying to get the text for a question. It may be caused by bad data or a bad block on the disk.

2. "Infotable Select Error!!!". "Cannot give examinee question at this ability level." This message indicates that all of the questions at a certain ability level in the infotable have been used. The program will search the next highest level in the infotable to select an item.

3. "No Strategy Question Select Error." This message means that all available questions in the item pool have been given. More questions for a subtest have been assigned than there are in the item pool.

4. "Question load error !!! No such question in directory". "Tried to load question # ...". "Directory_slot_..._____." This message occurs when the infotable data are not valid. The infotable contains a reference to a certain directory location that does not contain a question, a result of modifying the infotable without verifying it or deleting items from the item pool without checking the infotables.

SECTION 3
CONFIGURE TEST PARAMETERS PROGRAM
(MENU OPTION 3)

The Configure Test Parameters program sets up the parameters that control the method of test administration. Options appear in the program menu as follows:

```
CONFIGURE TEST PARAMETERS MENU [1.05]

Select one of the following procedures by entering its number.

    1. QUIT
    2. LOOK AT CURRENT PARAMETERS
    3. MODIFY SYSTEM PARAMETERS
    4. CONFIGURE FEEDBACK PARAMETERS

    Enter choice # :
```

1. QUIT

This option terminates the program and then branches back to the CAT project menu.

2. LOOK AT CURRENT PARAMETERS

Selecting this option will display the current configuration of the parameters that control the Test Administration program. The screen appears as follows:

```
TEST                  LENGTH  STRATEGY    CKERROR  STOPFLAG

Word Knowledge        15      B 108642    0.0      No
Numerical Operations  10      Timed       0.0      No
General Science       15      B 108642    0.0      No

Item : none     Subtest : screen     Session : printer
Press <RETURN> to continue
```

A few sample tests are included on the screen for illustration. The "TEST" column contains the names of the subtests. The "LENGTH" column shows the number of questions that will be given for each subtest. The

"STRATEGY" column tells what strategy (Bayesian or timed) is configured for each subtest. The "CKERROR" column contains the lower limit allowed for the variance of an examinee's estimated ability. "STOPFLAG" refers to the flag that will stop a session immediately following the completion of the subtest. Listed across the bottom of the display are the three parameters relating to feedback. These will be described in items 4.2 through 4.4 of this section.

3. MODIFY SYSTEM PARAMETERS

Selecting this option from the Configure Test Parameters Menu allows the user to set up or change the system parameters simply entering the number of the item on the following screen:

```
MODIFY PARAMETERS MENU

Select one of the following procedures by entering its number.

1. QUIT
2. MODIFY LIST OF SUBTESTS TO GIVE
3. ORDER THE SUBTESTS
4. CONFIGURE SUBTEST LENGTH
5. CONFIGURE STRATEGY
6. CONFIGURE VARIANCE CUT-OFF
7. CONFIGURE SUBTEST STOP FLAG

Enter choice # :
```

3.1. QUIT

This option in the Modify Parameters menu will cause the program to branch back to the Configure Test Parameters menu.

3.2. MODIFY LIST OF SUBTESTS TO GIVE

Selecting this option displays a list of the tests that are currently configured for administration and allows additions or deletions, as in the following example:

Tests currently in list	Instructions
Word Knowledge General Science Arithmetic Reasoning Numerical Operations	To add a subtest to the list, press the letter 'A.' You may have up to 20 subtests. To remove a subtest from the list, press <return> until the cursor is next to the subtest you wish to remove, then press the letter 'R.' Press 'Q' to quit.

3.3. ORDER THE SUBTESTS

This option allows the user to set the order in which the subtests will be administered. Only the subtests previously selected will be available for ordering. The subtests are listed in their current order. To reorder them, type the letter that corresponds to the test to be given first. This will transfer the test name from the "Current Order" column to the "New Order" column. Repeat this procedure until all subtests are in the "New Order" column. If the next desired subtest from the "Current Order" column is directly across from the cursor in the "New Order" column, then simply pressing <RETURN> will transfer that subtest directly to the "New Order" column. The following example illustrates the process of ordering the subtests:

Type the letter next to the subtest you wish to put in the new order, or press <return> to keep the same subtest in order.

New Order	Current Order
1. General Science	A. Word Knowledge
	C. Arithmetic Reasoning
	D. Numerical Operations

3.4. CONFIGURE SUBTEST LENGTH

With this option, the number of questions for any particular subtest may be set. The subtests are listed in one column, and the corresponding question totals are listed in a second column. Only the subtests selected in item 3.2 will be listed. To adjust the number of questions, press <RETURN> until the cursor is alongside the number to be changed. Then type in the new number (one or two digits), and press the <RETURN> key to accept the new value. The cursor can be moved repeatedly through the list. To accept the final configuration, press the letter "Q" (See the following example.)

From top of list, press <return> to keep old value. To change length, type the new value you want, then press <return>. Press 'Q' to quit.

Subtest	# of Questions
Word Knowledge	15
General Science	15
Arithmetic Reasoning	15
Numerical Operations	10

3.5. CONFIGURE STRATEGY

This option allows the user to select the strategy that will be used on a particular subtest. The subtests are listed along with their presently configured strategies, as in the following example:

Beginning at the top of the list, type <return> to keep old strategy or type the number of the strategy you want. Type 'Q' to quit.

Subtest	Strategy	Available Strategies
Word Knowledge	2. B 54321	0. NONE
General Science	3. B 108642	1. B 10 2 2 2 2
Arithmetic Reasoning	1. B 102222	2. B 5 4 3 2 1
Numerical Operations	4. Timed	3. B 10 8 6 4 2
		4. TIMED

Only the subtests that have been selected from item 3.2 for administration will appear in the list. To change a subtest to a different strategy, press <RETURN> until the cursor is positioned by the strategy of the test to be changed. Then type the number corresponding to the desired strategy. The list can be traversed repeatedly. When it is acceptable, type the letter "Q" to quit.

There are currently four types of strategies: three Bayesian (Owen, 1975) and one timed. With the timed strategy, questions are selected in the order they appear in the data base. The test administration will be halted when the prescribed time has elapsed. This time is inherent in the subtest name (see items 4 and 5, section 4). The Bayesian strategies involve computer controlled selection of questions based on the examinee's response to the previous question. An infotable contains references to the questions according to their difficulty level. If an examinee gets a question wrong, the computer selects one of the less difficult ones from the infotable. If he or she gets it right, a more difficult one is selected next. See also item 2, section 6.

When selecting the Bayesian strategy for a subtest, be certain that an infotable exists for that subtest. Otherwise errors will occur. Also, if the timed strategy is selected, make sure that the test name includes a time limit.

3.6. CONFIGURE VARIANCE CUT-OFF

This option allows a user to set the cut-off value for the variance of each subtest. Only the subtests selected for administration will appear for variance cut-off modification. The following example illustrates this process:

Beginning at the top of the list, type <return> to keep the old value or type in the value you want. Type 'Q' to quit.

Subtest	Check error value
General Science	0.0
Word Knowledge	0.0
Arithmetic Reasoning	0.0
Numerical Operations	0.0

The Bayesian strategy involves an estimated ability level and also a statistical variance of that estimate. For any subtest, a lower limit for the variance may be set to stop the subtest if the variance falls below it. Administering more questions will have no significant effect on the estimated ability.

3.7. CONFIGURE SUBTEST STOP FLAG

With this option, a flag may be set to stop a series of tests immediately following the one(s) flagged. This flag may be set to call a proctor, to prevent simultaneous writing to a multiplexed hard disk by two or more examinees, or for other reasons. A list of the available subtests is given along with the current configuration of flags. Only the subtests selected in item 3.2 for administration will be listed. If a flag is desired, press <RETURN> until the cursor is next to the subtest to be flagged. Then type 'Y' to set the flag. Typing 'N' will turn the flag off. An example follows:

Beginning at the top of the list, type <return> to keep the old value or press 'Y' or 'N'. Type 'Q' to quit.

Subtest	Stop
General Science	no
Word Knowledge	no
Arithmetic Reasoning	no
Numerical Operations	no

4. CONFIGURE FEEDBACK PARAMETERS

The feedback parameters are optional flags that may be used to indicate an examinee's performance. Any or all of the three types can be configured to display the performance of an examinee after each question, after each subtest, or after the session has been completed (see the following menu).

CONFIGURE FEEDBACK MENU

Select one of the following options by entering its number.

1. QUIT
2. CONFIGURE QUESTION FEEDBACK
3. CONFIGURE SUBTEST FEEDBACK
4. CONFIGURE SESSION FEEDBACK

Enter Choice # :

4.1. QUIT

This option in the Configure Feedback Parameters menu will make the program branch to the Configure Test Parameters menu.

4.2. CONFIGURE QUESTION FEEDBACK

Selecting this option allows the user to set flags so that the correct answer will appear on the screen after each question has been answered by the examinee. Another option gives no feedback, in which case each question is followed by the next without any indication of the examinee's performance. A record of performance is kept internally, however, in case other types of feedback are selected. A third option provides another question for each incorrect response. The current state is indicated at the top of the menu and also by displaying that state in reverse video on the display screen. At present, question feedback exists only for multiple-choice questions. Typing the number of the desired option will set the flag. See the following example for a display of these options:

QUESTION FEEDBACK MENU

Select one of the following options by entering its number.

You currently have option : 2

1. QUIT
2. NO QUESTION FEEDBACK
3. RIGHT-WRONG QUESTION FEEDBACK
4. REMEDIAL QUESTION FEEDBACK

Enter Choice # :

4.3. CONFIGURE SUBTEST FEEDBACK

This option allows the user to set a flag that sends a summary of the examinee's performance to the screen or to a printer after a subtest is completed. For the Bayesian strategy (Owen, 1975), this summary is a graph showing the relative percentile that applies to the examinee after each question. Other strategies may show a different summary format. The options are shown in the illustration that follows. The number of the current option appears at the top of the menu and that option is also displayed in reverse video. Typing a different number will change the flag. Typing "1" will accept

the one displayed.

SUBTEST FEEDBACK MENU

Select one of the following options by entering its number.

You currently have option : 2

1. QUIT
2. NO SUBTEST FEEDBACK
3. SUBTEST FEEDBACK TO SCREEN
4. SUBTEST FEEDBACK TO PRINTER
5. SUBTEST FEEDBACK TO SCREEN AND PRINTER

Enter Choice # :

_

4.4. CONFIGURE SESSION FEEDBACK

Selecting this option allows flags to be set to display or print a summary of the examinee's performance for each subtest, but only after the final subtest has been completed. The following illustration presents the available options:

SESSION FEEDBACK MENU

Select one of the following options by entering its number.

You currently have option : 2

1. QUIT
2. NO SESSION FEEDBACK
3. SESSION FEEDBACK TO SCREEN
4. SESSION FEEDBACK TO PRINTER
5. SESSION FEEDBACK TO SCREEN AND PRINTER

Enter Choice # :

SECTION 4
TEST DATA BASE MANAGEMENT PROGRAM
(MENU OPTION 4)

The Test Data Base Management program interacts with the subtests and item pool banks. It allows creation, modification, and deletion of subtests and items. It may be run by selecting the Test Data Base Management option from the CAT Project menu or by directly executing "CATDATA:T.MGR." See the figure below for available options:

TEST MANAGER MENU [1.05]

Select one of the following procedures by entering its number.

1. QUIT
2. FETCH A SUBTEST
3. LIST DIRECTORY
4. CREATE NEW SUBTEST
5. CHANGE SUBTEST NAME/FORMAT
6. TRANSFER SUBTEST TO FLOPPY
7. DELETE SUBTEST
8. SEARCH TEXT FOR KEYWORDS

Enter choice # :

1. QUIT

This option in the Test Manager menu terminates the program and then branches back to the CAT project menu.

2. FETCH A SUBTEST

Selecting this option from the Test Manager menu will display the subtests in a format similar to that shown in the following figure, which includes several sample subtests for illustration:

LIST OF SUBTESTS

1. Arithmetic Reasoning
2. Numerical Operations
3. Word Knowledge
4. General Science

INSTRUCTIONS : Enter choice #, then press <RET>.
To escape, press 0, then <RET>.

Fetch which test? :

After selecting a subtest, several options are available, as shown in the following illustration:

FETCH SUBTEST MENU

Select one of the following procedures by entering its number.

Currently managing subtest : - - - -

1. QUIT
2. ADD A NEW QUESTION
3. FETCH A QUESTION
4. LIST SUBTEST QUESTIONS
5. SAMPLE QUESTION MANAGEMENT
6. SUBTEST INSTRUCTIONS MANAGEMENT

Enter choice # :

2.1. QUIT

This option in the Fetch Subtest menu causes the program to branch back to the Test Manager menu.

2.2. ADD A NEW QUESTION

The item pool has a capacity of 295 questions per subtest. To get into the insert question mode, the user must get to the Fetch Subtest menu. This occurs when a new subtest is created, or when the user has selected the Fetch a Subtest option from the Test Manager menu. To insert questions for that subtest, select the Add a New Question option in the Fetch Subtest menu. A prompt appears as in the following illustration. An integer value is expected for the question code number.

Enter the question code #, then press <RETURN> :

Then the text editor routine for questions is called. The screen goes blank, awaiting entry of text for a question. The available options are as follows:

<left arrow>	: Moves cursor one space to the left.
<right arrow>	: Moves cursor one space to the right.
<CONTROL-P>	: Gets another page to continue with the text editing. But first an oportunity is given to check and modify the current page.
<CONTROL-C>	: Accepts all text, quits, and updates the file.

The available screen area is determined by certain parameters in the subtest name (see item 6). The bottom four lines are reserved for system messages. Features included in the text editor are nonvolatile backspace and automatic line wrap-around. The question, along with the answer selections, should be entered. The screen appears exactly as it will during the Test Administration. When the text is satisfactory, press <CONTROL-C>. If the question is a graphics item, no text need be typed; <CONTROL-C> is all that is needed. After the text has been entered, and <CONTROL-C> is pressed, the Set Graphics Flag menu is called.

The Set Graphics Flag menu is used to indicate to the program that the question contains graphics. All graphic questions are saved as fotofiles or compressed graphic data files on volume "CATFOTO." To load the question from a graphics file, the flag must be on. If it is not a graphics item, the flag must be off. An error will occur if the flag is on with no corresponding fotofile. The following figure illustrates the Graphics Flag menu:

SET GRAPHICS FLAG MENU

Select one of the following options by entering its number.

You currently have option 2 (no graphic text)

1. QUIT
2. GRAPHICS FLAG OFF (no graphic text)
3. NORMAL GRAPHICS FLAG ON
4. COMPRESSED GRAPHICS FLAG ON

Enter Choice # : –

Turn a graphics flag on or off by selecting the number from the Set Graphics Flag menu. Then type "1" to quit.

Next, select the type of answer for this question as shown below:

SELECT ANSWER TYPE

Select one of the following options by entering its number.

1. MULTIPLE CHOICE/SINGLE ANSWER
2. INTEGER VALUE ANSWER
3. MULTIPLE CHOICE/MULTIPLE ANSWER

Enter Choice # :

The option most often used is multiple choice/single answer, while the other two options are used for subtests with special formats. Select one of these three forms. After either option 1 or 3 are chosen, the following will apear:

ENTER ANSWER SELECTION RANGE

Low bound? (letter/digit) :

High bound? :

A low bound and a high bound are requested. These will be alphanumeric characters constituting the range of the answer selections. For example, a question with four choices for the answer will probably have a range "A..D" or "1..4." Enter the range. Next, the answer is requested. The following illustrate sample display screens for each of the three possible responses to the Select Answer Type menu:

```
ENTER MULTIPLE CHOICE/SINGLE ANSWER

The answer range is : A..D

Enter answer and then press <RET> :
```

```
ENTER INTEGER VALUE ANSWER

Enter answer (integer value) and then press <RET> :
```

```
ENTER MULTIPLE CHOICE/MULTIPLE ANSWERS

The answer range is : A..D

Enter the number of answers this question has (1..7) : 2

Enter answer 1, then press <RET> :

Enter answer 2, then press <RET> :
```

Finally, three parameters, A,B, and C, are entered. Real numbers are expected here. The "A" parameter is an ability discrimination factor related to the slope of the item characteristic curve. The "B" parameter is a difficulty factor. The "C" parameter is a guessing factor. The screen appears as follows:

Enter A parameter value, then press <RET> :

Enter B parameter value, then press <RET> :

Enter C parameter value, then press <RET> :

After entering these parameters, the data should be verified by the user. The screen appears as illustrated below. If everything is correct, type "1," and the question will be accepted into the data base. If an item is incorrect, it can be altered by typing the appropriate number.

VERIFY QUESTION DATA MENU

Select one of the following options by entering its number.

Current data : A parameter =
B parameter =
C parameter = –

1. QUIT (data ok)
2. CHANGE PARAMETER A
3. CHANGE PARAMETER B
4. CHANGE PARAMETER C

Enter Choice # :

2.3. FETCH A QUESTION

Selecting this option gives several choices. Enter the question's item code as an integer value. If no item in the data base matches the code number entered, the program will display an error message and then branch back to the Fetch a Subtest menu. If the item is found, the screen appears as follows:.

FETCH ITEM MENU

Select one of the following options by entering its number.

Currently managing question : - - -

1. QUIT
2. DISPLAY QUESTION TEXT
3. DISPLAY QUESTION DATA
4. MODIFY QUESTION
5. DELETE QUESTION
6. SET GRAPHICS FLAG

Enter choice # :

2.3.1. QUIT

This option in the Fetch Item menu causes the program to branch back to Fetch Subtest menu.

2.3.2. DISPLAY QUESTION TEXT

Select this option from the Fetch Item menu to view the text for a question. The text will appear on the screen exactly as it would during the actual test, except that the item code and the correct answer are also shown.

2.3.3. DISPLAY QUESTION DATA

When this option is chosen from the Fetch Item menu, a summary of the data for the question is displayed as follows:

QUESTION DATA

A Parameter :
B Parameter :
C Parameter :
Answer type :
Answer :
Graphics Flag :
Block which text begins :
Byte in block :

Press <RET> to continue

2.3.4. MODIFY QUESTION

This selection from the Fetch Item menu brings up the following menu. Either the text or data parameters for any question in the data base may be modified using this option.

MODIFY QUESTION MENU

Select one of the following by entering its number.

Currently managing SESSION files.

1. QUIT
2. CHANGE QUESTION CODE
3. CHANGE QUESTION TEXT
4. CHANGE ANSWER RANGE
5. CHANGE ANSWER
6. CHANGE QUESTION DATA

Enter choice # :

2.3.4.1. QUIT

This option in the Modify Question menu will cause the program to branch back to the Fetch Item menu.

2.3.4.2. CHANGE QUESTION CODE

This option in the Modify Question menu allows a change in the item code number for the question under consideration. It can cause problems in other parts of the program unless care is taken. Notice the warning message shown in the following figure. The Strategy Data Base Management program must be run after modifying a question.

> The current question ID code is : _ _ _
>
> Enter the new identification code and then press <return> :
>
> The new ID # is :
>
> ******* IMPORTANT *******
>
> Since you have changed the question ID code, this may affect the strategy data base structures. The strategy database may contain the item just changed and, if so, errors may occur during test administration when the strategy selects a question no longer identified by its old ID #. Thus, to make sure the strategy data is still OK, you should run the 'Verify' option for each strategy data structure this subtest has.
>
> Press <return> to continue

2.3.4.3. CHANGE QUESTION TEXT

Selecting this option from the Modify Question menu displays the old text for the question and puts the user in the editor mode for test questions. New text can be added or old text deleted and changed. Typing <CONTROL-C> will accept the text on the screen as the new text for the question.

2.3.4.4. CHANGE ANSWER RANGE

This option in the Modify Question menu gives the user an opportunity to expand or diminish the range of possible answers for an item. When the current range is displayed, the new values are requested. These may be any letter or digit. For example, an old range of "A..D" may be changed to "1..5," as in the following example:

```
Current range : A..D

New low bound? (letter/digit) : 1
New high bound? (letter/digit) : 5

The new range is : 1..5

Press <RET> to continue
```

After <RETURN> is pressed, the program branches back to the Modify Question menu.

2.3.4.5. CHANGE ANSWER

This option in the Modify Question Menu is similar to Add a New Question in the Fetch Subtest menu. The current answer is displayed first. Then the new data are typed in if this were a new question, beginning with the answer type. The menus are the same as the Fetch Subtest menus.

2.3.4.6. CHANGE QUESTION DATA

This option in the Modify Question menu displays the same menu as the Verify Question Data menu presented previously. It facilitates changing the A,B, & C parameters.

2.3.5. DELETE QUESTION

Deleting a question removes it from the subtest directory. The empty space is indicated by "-1". To prevent accidental deletions, a warning is given beforehand as in the following illustration. VERIFY the strategy data base after deleting.

********** WARNING **********

You have selected the delete question option. This will remove the question from the subtest item pool. Are you sure you want to delete __ ?

Press 'N' or 'Y' : Y

Deleting ...

2.3.6. SET GRAPHICS FLAG

Setting the graphics flag informs the Test Administration program that the text for this particular question is graphic and is in a fotofile or compressed graphic data file. If the flag is set when no graphics file exists for the question, an IO error will occur. To change the flag, select Fetch a Subtest, Fetch a Question, and Set a Graphics Flag. The menu that appears will be the current state of the flag. Set or reset it by typing the appropriate number. The following figure presents the Set Graphics Flag menu:

SET GRAPHICS FLAG MENU

Select one of the following options by entering its number.

You currently have option 2 (no graphic text)

1. QUIT
2. GRAPHICS FLAG OFF (no graphic text)
3. NORMAL GRAPHICS FLAG ON
4. COMPRESSED GRAPHICS FLAG ON

Enter Choice # :

2.4. LIST SUBTEST QUESTIONS

To list the entire subtest (instructions, samples, and the item pool), select List Subtest Questions from the Fetch Subtest menu. The following screen will appear:

Select one of the following options by entering its number.

1. QUIT
2. COMPLETE LISTING
3. PARTIAL LISTING

Enter Choice # :

It is possible to select the Complete Listing option and list the text to the screen, terminating the listing after any single question has been displayed by pressing the <ESCAPE> key. If a printed copy of the items in a particular subtest is needed, the Output Selection menu allows that option. The "data" referred to in the menu contain all of the parameters for each item. The name of the file will be needed for options 6 and 7 (see the following illustration).

OUTPUT SELECTION MENU

Select one of the following options by entering its number.

1. QUIT
2. TEXT TO CONSOLE
3. DATA TO CONSOLE
4. TEXT TO PRINTER
5. DATA TO PRINTER
6. TEXT TO FILE
7. DATA TO FILE

Enter choice # :

If a partial listing is desired, the range of item codes is requested as shown in the following screen. Only the items within that range will be listed. The same options are available for a partial list as for the complete list.

ENTER RANGE OF ITEM CODES TO LIST

List all items between item code :

and item code :

2.5. SAMPLE QUESTION MANAGEMENT

Selecting this option from the Fetch Subtest menu gives access to the sample items for the current subtest. Each subtest has space for a maximum of five sample questions. The Test Administration program will display as many samples as exist for the subtest, through the following menu:

SUBTEST SAMPLES MENU

Select one of the following procedures by entering its number:

1. QUIT
2. ENTER SAMPLE QUESTION
3. VIEW SAMPLE QUESTION
4. MODIFY SAMPLE QUESTION
5. DELETE SAMPLE QUESTION

Enter Choice # :

2.5.1. QUIT

This option in the Subtest Samples menu causes the program to branch back to the Fetch Subtest menu.

2.5.2. ENTER SAMPLE QUESTION

This option allows a user to enter a new sample question for the subtest. The screen first displays the number of sample questions already created. For example, if two samples exist, the display will appear as follows:

```
Sample question 1 exists.
Sample question 2 exists.

Make which sample question (1..5)
Enter the number then press <RET> :
```

The new question should be given the next number in sequence, in this case number 3. After the number is entered, the screen goes blank, awaiting the text for the sample question. The sequence of entries and display screens is identical to that for the Add a New Question option of the Fetch Subtest menu. The A, B, and C parameters are not entered for sample questions.

2.5.3. VIEW SAMPLE QUESTION

This option will allow a user to select any of the sample questions that exist for this subtest and display it on the screen. The display appears as follows:

```
View which sample question (1..5)
Enter the number then press <RET> :
```

2.5.4. MODIFY SAMPLE QUESTION

This option allows a user to modify the text, answer range, answer, or graphics flag of a sample question. Each modification selection displays the part of the program that made the original sample question. That is, the selection of Modify Sample Text allows the editing of the text for the sample question, Modify Answer displays the old answer and requests the new answer, Modify Answer Range displays the old range and requests the new low bound and high bound, and Modify Graphics Flag shows the current option and allows the flag to be set or reset. The menu appears as follows:

MODIFY SAMPLE QUESTIONS MENU

Select one of the following procedures by entering its number:

1. QUIT
2. MODIFY SAMPLE TEXT
3. MODIFY SAMPLE ANSWER
4. MODIFY SAMPLE ANSWER RANGE
5. MODIFY GRAPHICS FLAG

Enter Choice # :

2.5.5. DELETE SAMPLE QUESTION

Selecting this option allows any sample question currently in a subtest to be deleted. After a sample question is deleted, the number of that question may be used again by entering a new sample question. The screen presents the following warning:

******* WARNING *******

You have selected the 'delete sample question' option. This will purge an existing sample question from the files.

Do you wish to continue? Press 'N' or 'Y' :

2.6. SUBTEST INSTRUCTIONS MANAGEMENT

Selecting this option from the Fetch Subtest menu allows a user to enter, modify, delete, or view the instructions displayed on the screen before a subtest. These instructions consist of general text information that the examinee needs before beginning the subtest. If no instructions exist for a subtest, the program for Test Administration skips over this part. That is, it does not try to give instructions if none can be found, and no error occurs. The menu is displayed as follows:

SUBTEST INSTRUCTIONS MENU

Select one of the following procedures by entering its number:

1. QUIT
2. ENTER INSTRUCTIONS
3. VIEW INSTRUCTIONS
4. MODIFY INSTRUCTIONS
5. DELETE INSTRUCTIONS

Enter Choice # :

2.6.1. QUIT

This option in the Subtest Instructions menu causes the program to branch back to the Fetch Subtest menu.

2.6.2. ENTER INSTRUCTIONS

This option allows the user to enter text for subtest instructions. If instructions already exist, an error message is displayed. To add to those instructions, either delete them and enter the new ones, or select the modify option, which displays an empty screen and asks for the text. It is accepted by pressing <CONTROL-C>.

2.6.3. VIEW INSTRUCTIONS

This option will display the subtest instructions on the screen. The text appears just as it would during the test administration.

2.6.4. MODIFY INSTRUCTIONS

This option allows a user to change the subtest instructions. This option displays the old text and puts the user in the test text editor to add, delete, or change the old text. A chance to escape this option is given as follows:

Change instruction text? Press 'N' or 'Y' :

2.6.5. DELETE INSTRUCTIONS

This option removes all instructions for a subtest. Because it destroys the only copy of these instructions, a warning is displayed first, as follows:

```
******** WARNING ********

You have selected the 'delete instructions' option. This
will purge the existing instructions from the files.

Do you wish to delete the instructions? Press 'N' or 'Y' :
```

This option concludes the documentation for the Fetch Subtest option in the Test Manager menu (page I.1). The next few pages will present the remaining choices in the Test Manager menu.

3. LIST DIRECTORY

This option in the Test Manager menu displays the directory of subtests along with the number of questions contained in each. The list of subtests is displayed, and pressing <RETURN> will cause the program to branch back to the Test Manager menu. See the following example for format:

```
                    LIST OF SUBTESTS

1. Arithmetic Reasoning (201)      3. Word Knowledge (194)
2. Numerical Operations (50)       4. General Science  (197)

4 files in directory, 17 unused.

Press <RET> to continue
```

4. CREATE NEW SUBTEST

Selecting this option in the Test Manager menu allows a user to create a new subtest, to the maximum of 21 subtests that can exist in the CAT system. This part of the program puts only the name of the new subtest into the directory. Then the program branches to Fetch a Subtest for entering questions and parameters. The following figure illustrates the screen that appears for this option:

SUBTEST NAME FORMAT INSTRUCTIONS

The first character of the subtest name specifies which screen format the question text will appear in. The screen codes are listed below. The second character of the subtest name specifies the total permitted time in minutes for timed subtests. The second and third characters specify the addition seconds permitted for the timed tests. Type in the subtest name and press <RETURN>.

'*' as first char = inverse + 80 columns
'@' as first char = normal + 80 columns
'?' as first char = normal + 40 columns

If first character of test name is not any of the above control characters, then the text format will default to :
inverse + 40 columns.

Change --- --- to what ?

After the subtest name has been entered, the next menu to appear is the Fetch Subtest menu.

5. CHANGE SUBTEST NAME/FORMAT

The name of a subtest can easily be changed by selecting this option, which is organized like the Create a New Subtest option (item 4, above). The first thing that appears on the screen is a list of all of the subtests currently in the directory. A prompt appears asking for the subtest name to be changed. After the user enters the number of the desired subtest, the format of the new name is described. Enter the name as if it were a new subtest. The format of a subtest can be changed in a similar manner. Again, it is treated as if a new subtest were being created; the entire name, including the format characters, is typed in place of the old name (see section 4). If the text for a question in a subtest is typed on an 80-column screen, it cannot be displayed on a 40-column screen. Likewise, if it was typed on a 40-column screen originally, it will appear off to the side on an 80-column screen. Thus, if the format is changed after the text has been entered, it may not appear as intended. This option also allows a time limit to be set for timed subtests. The test administration program keeps track of the time an examinee spends on each subtest. For a timed subtest, the test is halted when the allotted time has expired. This allotted time is specified by three digits in the subtest name, as in item 4.

6. TRANSFER SUBTEST TO FLOPPY

Existing data files are too large for a floppy disk. This option will isolate an individual test and write its data on a floppy disk in a format similar to the large data file. The program F.TMGR allows access to the floppy file. It contains procedures similar to T.MGR, but designed to access a floppy. A list of the available subtests is displayed, requesting the name of the test to transfer. Then a prompt appears on the screen as follows:

```
Enter destination file name, then press <RETURN>

------>
```

The destination file name should be no more than four characters in length. It can be prefixed with a volume name. Three data files are created using the filename, as follows:

1. /volume/file name .DIR.DATA, 2. /volume/file name .DATA.DATA, 3. /volume/file name .TEXT.DATA.

The first file is the subtest directory, the second contains the data and parameters for the questions in the subtest, and the third file contains the text for the questions.

7. DELETE SUBTEST

This option allows the user to remove an unwanted subtest permanently, by removing the subtest name from the directory and then removing any reference pointers to the questions. Because the deletion is permanent, the following warning is displayed first:

```
********** WARNING **********

You have selected the 'Delete Subtest' option. This will
purge the subtest directory from the database and the
item banks for the subtest will cease to exist.

Do you wish to continue? Press 'N' or 'Y' :
                                                  _
```

Pressing 'N' branches back to the Test Manager menu (page I-1). Pressing 'Y' displays the directory of subtests. The prompt requests the number of the

subtests to be deleted. Upon selection of a subtest, one more chance is given to escape, as follows:

Purge (TEST NAME)? Press 'Y' or 'N' :

Pressing 'N' again branches to the Test Manager menu. Pressing 'Y' begins the deletion process. A dot is written on the screen for each question in the data base as its reference pointer is deleted. Then the program branches to the Test Manager menu.

8. SEARCH TEXT FOR KEYWORDS

This option allows the user to search the item text data base for up to ten key words. The user must first choose the subtest to be searched from the List of Subtests menu. The user must then enter the number of key words to be searched in the data base of the chosen subtest. The program will prompt the user for the key word(s) and then return with the Output Selection menu. The Output Selection menu provides the user with the options of sending the text containing these key words to the console, to a printer, or to a text file. A quit option exists to return to the Test Manager menu. Once an output option has been selected, the program will perform the search process, output the results, and then branch back to the Test Manager menu.

SECTION 5
EXAMINEE DATA BASE MANAGEMENT PROGRAM
(MENU OPTION 5)

The Examinee Data Base Manageement program maintains and provides access to a data base of up to 50 examinees. An examinee must be logged into this data base to be administered a series of subtests. Logging in reserves space in memory for the results of the examinee's testing. The initial menu is as follows:

```
EXAMINEE MANAGER MENU [1.05]

Select one of the following procedures by entering its number.

Currently managing SESSION files.

    1. QUIT
    2. LOG EXAMINEE INTO SYSTEM
    3. ENTER EXAMINEE PERSONAL DATA
    4. VIEW EXAMINEE RECORDS
    5. LIST DIRECTORY
    6. SEPARATE DONE/NOT DONE EXAMINEES
    7. SELECT FILES TO MANAGE
    8. REMOVE EXAMINEE
    9. PURGE DIRECTORY

     Enter choice # :
```

1. QUIT

This option in the Examinee Data Base Menu terminates the Examinee Manager program and then branches back to the CAT Project menu.

2. LOG EXAMINEE INTO SYSTEM

When an examinee's social security number is entered, it is either accepted or rejected, depending on whether the limit of 50 examinees has been reached, whether the examinee has previously logged in, and whether the examinee has already finished with testing. The screen displays the following:

Enter Examinee Social Security number : ____<RETURN>

The computer checks to see whether that number exists already. If so, an error message is displayed. Otherwise, the number is entered into the data base and the screen appears as follows:

Examinee (_____) entered into system.

Press <RET> to continue logging in examinees or
press <ESC> to quit.

3. ENTER EXAMINEE PERSONAL DATA

With this option a proctor may enter or modify an examinee's personal data record. The record consists of various fields, each of which is restricted to a certain type of input. Some fields may contain only digits, some only alphabetic characters, and some both. The date field requires a "/" to separate day, month, and year. If inappropriate data are entered, an error bell will sound. First, the examinee's social security number is requested. If the social security number has not been logged in previously, an error message is printed. Otherwise the screen appears as follows:

DATA ENTRY INSTRUCTIONS : To enter/modify data, type in the data you want and then press <RET> to accept that data. To skip the current field, just press <RET>. To quit, press <ESC>.

Last Name : First Name : Middle Initial :
Current Address (state) : Home of Record (state) :
Citizenship :
Sex :
Population Group :
Ethnic Group :
Marital Status :
Number of Dependents :
Date of Birth :
Education :
Test ID :
AFQT :
ASVAB Scores :
Date of Enlistment :
Active Service Date :
Rating / MOS :
AFEES :
Branch of Service :
Retest ASVAB :
Test order :

After the data have been entered, certain items are requested a second time in a check to confirm that the data are correct. For this check, the screen appears as follows:

Last name :
ASVAB Scores :
Rating / MOS :
Retest ASVAB scores :

The computer compares the two entries for each of these important items; if they do not match, an error message is displayed. Otherwise the screen shows the following comparisons:

Previous Last Name :
Verified Last Name :

Previous ASVAB Scores :
Verified ASVAB Scores :

Previous Rating / MOS :
Verified Rating / MOS :

Previous Retest ASVAB Scores :
Verified Retest ASVAB Scores :

Verified data is ok.

Press <RET> to continue.

4. VIEW EXAMINEE RECORDS

This option allows a proctor to transfer an examinee record to the console, a printer, or a file. The record displayed contains the examinee's personal data and all subtest results. The procedure requests first the examinee's social security number and then a destination for the output. The console and printer options display a long tabular summary. The file option writes a compressed version into a text file for the SPSS data analysis. The record displayed has the same format as the one displayed for option 3, without the instructions at the top.

5. LIST DIRECTORY

This option displays the list of examinees logged into the system and the corresponding current status in the testing sequence. The status of the examinee is one of the following: new examinee--no subtest started; done examinee--session fully completed; or examinee with some subtests completed--the number of finished tests is indicated.

6. SEPARATE DONE/NOT DONE EXAMINEES

When this option is selected, data for examinees who have finished all of the assigned subtests are transferred to another file whose format is identical to the first. Thus, two similar file systems exist, one with examinees who are finished, and one with those who are not. This arrangement allows the E.MGR program to access either file with the same routines.

7. SELECT FILES TO MANAGE

Access to examinee files is separated into two categories: Files of examinees currently in session, and files of examinees who have completed the test. The user must specify which group of files to be managed through the Select Files to Manage option. When this option is chosen, a menu will appear as in the following diagram. The user must enter a choice number and then press the "1" key option to quit the screen. The program will then branch back to the Examinee Manager menu with the selected file structure indicated in the heading. The options described previously in this section for file management may then be used.

SPECIFY FILES MENU

Select one of the options by entering its #

You currently have option: 2

1. QUIT
2. MANAGE SESSION FILES
3. MANAGE DONE EXAMINEES

Enter choice #:

8. REMOVE EXAMINEE

This option deletes a specified examinee from the files. It is used to remove examinees for whom data are no longer required. Deletion is accomplished by entering the examinee's ID number in the specified space on the screen.

9. PURGE DIRECTORY

When the data for all examinees are no longer needed, this option removes all the examinee records and the directory, thus allowing 50 new examinees to be logged in.

SECTION 6
STRATEGY DATA BASE MANAGEMENT PROGRAM
(MENU OPTION 6)

The Strategy Data Base Management program handles the data structures used in selecting questions to be given an examinee during test administration. Currently, two strategies are used. A timed test selects questions in the same order as they appear in the data base, and all examinees are given identical tests. That strategy does not involve the use of this program at all. The other strategy (option 2, below) uses Bayesian formulas and techniques (Owen, 1975), and involves an information table of questions for each subtest. Two more strategies are listed in the menu but have not yet been implemented.

STRATEGY DATABASE MENU [1.05]

Select one of the following procedures by entering its number.

1. QUIT
2. INFOTABLE MANAGEMENT
3. PYRAMIDAL MANAGEMENT (not available)
4. FLEXILEVEL MANAGEMENT (not available)

Enter choice # :

Note. Pyramidal Management and Flexilevel Management, options 3 and 4, are not being implemented in the current version of the CAT system.

1. QUIT

This option in the Strategy Data Base menu terminates the Strategy Manager program and then branches back to the CAT Project menu.

2. INFOTABLE MANAGEMENT

Selecting this option in the Strategy Data Base menu gives access to the information table data structure in order to create, modify, verify, or view the infotable. Basically, the infotable is a matrix of 36 rows by 20 columns; each entry is a number that refers to a question in the data base. There are actually two such tables for each subtest. The one visible to the user contains item code numbers of the questions referred to. A second table contains the actual location in the data base of the corresponding question. It is this second table that is used by the program to access the file of questions and retrieve a question to be administered.

The rows of the infotable correspond to ability levels. The items in each row of the information table are sorted in order of information, with the first item having the greatest information for that level of ability. Row 0 contains the sequence of item numbers whose information values were calculated at a theta value of -2.25. The information values in row 1 were calculated for a theta value of -2.125, and so on. When a subtest is administered, the first question is selected from row 19 (theta value of 0). The first five items in that row (columns 1 to 5) are taken as a group from which a question is chosen at random. This random selection prevents two adjacent examinees from getting the same test. After an examinee answers a question, a new ability level is calculated, based on whether the answer was correct or incorrect, and the next question is selected at random from the row corresponding to the new ability level. The process is repeated until the end of the subtest. Since the same item code number can appear in more than one row, items that have already been used are ignored when selecting a group of five questions from which to make a random selection. When this option is chosen, the screen appears as follows:

INFOTABLE MANAGER MENU

Select one of the following procedures by entering its number.

1. QUIT
2. MAKE NEW INFOTABLE
3. LIST INFOTABLE
4. VERIFY INFOTABLE
5. MODIFY INFOTABLE
6. FIND ITEMS IN INFOTABLE
7. ANALYZE INFOTABLE ROWS

Enter choice # :

2.1. QUIT

This option in the Infotable Manager menu will cause the program to branch to the Strategy Data Base menu.

2.2. MAKE NEW INFOTABLE

This option allows the creation of an information table where none existed before, or where an old one is to be replaced by a new one. First, a list of subtests similar to the following one is displayed:

```
LIST OF SUBTESTS

1. Arithmetic Reasoning      3. Word knowledge
2. Numerical Operations      4. General Science

INSTRUCTIONS : Enter choice #, then press <RET>
               To escape, press 0, then <RET>

Make new infotable for which test?
```

A test is selected by entering its corresponding number. The options available for making an infotable are listed in the following menu:

```
MAKE INFOTABLE FOR : __

Select one of the following options by entering its number.

1. QUIT
2. INFOTABLE FOR A SINGLE ABILITY LEVEL THETA
3. READ INFOTABLE VALUES FROM A TEXTFILE
4. COMPUTE INFOTABLE VALUES FROM INTERNAL PARAMS

Enter choice # :
```

2.2.1. QUIT

Selecting this option from the Make Infotable menu will cause the program to branch back to the Infotable Manager menu.

2.2.2. INFOTABLE FOR A SINGLE ABILITY LEVEL THETA

This option calculates the actual information value for each question in the data base. The A, B, and C parameters in the data base are used along with any desired value for theta, which is input from the keyboard to perform the calculations:

ENTER ABILITY LEVEL (real number between -2.5 and +2.5)
(If a number is between 0 and 1, it must be entered as 0.)

THETA :

The formula for the calculation of infovalues is complex, but it can be examined by looking at the text file listing for the Strategy Data Base Management program. It is in INFO, a function located in text file SMGR.DIR/S.NEW.TEXT. For each of 36 ability levels, this function returns a value for a single item in the data base. The function is called once for each item included in a subtest. The values returned by the function are placed into an array along with their corresponding item code numbers. The values are then sorted, with the largest first since the largest information value implies that this particular question is the best one to use for this ability level. Once the values are sorted, the entire array is printed on the screen or a printer as shown in the following:

Where do you want to send the output?

1) Screen
2) Printer

SORTED INFOTABLE FOR General Science T = 1.500

ITEM	INFOVALUE	ITEM	INFOVALUE	ITEM	INFOVALUE
1317	3.7846830	1422	3.5725095	28	3.4566457
717	2.6544909	1012	2.2363446	929	2.1980641
1429	1.8138728	27	1.2964287	1501	1.2836412
210	1.0873929	626	1.0362686	1103	1.0162244
1001	1.0002778	1024	0.9402365	204	0.9360374
11	0.9227784	802	0.9031849	822	0.8506458
114	0.8394207	9	0.8175129	620	0.8102215
201	0.7606946	813	0.7527739	1212	0.7054430
707	0.6530995	709	0.6500925	1223	0.6418954

2.2.3. READ INFOTABLE VALUES FROM A TEXTFILE

Selecting this option allows the user to create the infotables on a different computer and transfer them to this data base via a floppy disk or other medium. The program reads a text file and enters the data into the array for the infotable. The file must contain information in the following format:

a. There must be exactly 720 integers (each one corresponding to an item code number).

b. Since the infotable consists of 36 rows of 20 items, the file can be read directly into the infotable array, and is read one row at a time. Thus, each item in the file must be in exactly the same position it will be in the infotable.

c. Integers must be separated by at least one blank or a linefeed/carriage return.

d. No characters are allowed; only integers. The screen prompts the user to enter the name of the file as follows:

> Enter input filename, then press <RET> :

After reading the file, a check is made internally to assure that the correct number of items were entered; if they were not, an error message is displayed.

2.2.4. COMPUTE INFOTABLE VALUES FROM INTERNAL PARAMS

Selecting this option allows the user simply to sit back and watch the computer do all the work. As soon as the option is selected, the A, B, and C parameters for this subtest are loaded from the data base. The screen displays an information line to let the user know that something is happening (it takes a few seconds to load).

> Loading parameters from file.....

Then the computer calculates an information value for each of the questions similarly to option 2.2.2, above. The value of theta initially is -2.25. After the information values have been computed for this theta, the items are sorted and the best 20 are placed into the infotable's first row. The screen appears as follows, writing dots occasionally to indicate that the computer is working:

```
Computing infovalues for THETA = -2.2500
.....

Sorting the infotable .....
```

Theta is then incremented by 0.125 and the process is repeated, continuing until all 36 rows have been computed, sorted, and stored. Depending on the number of questions in the subtest's data base, the process of creating the new infotable can take up to 30 minutes. The program will branch to the "verify" option (see section 2.4) after the new infotable has been completed.

2.3. LIST INFOTABLE

This option will list the infotable on the screen, a printer, or to a file, as follows:

```
SELECT OUTPUT MENU

Select one of the following options by entering its number.

1. QUIT
2. LIST INFOTABLE TO SCREEN
3. LIST INFOTABLE TO PRINTER
4. LIST INFOTABLE TO FLOPPY DATA FILE
5. LIST INFOTABLE TO TEXT FILE
```

The printed infotable has item code numbers as values in the table. A partial sample (with 8 columns instead of 20) is shown in the following table. An option exists that is hidden from the average user due to its limited value. The actual infotable that is used by the program consists of offset values that index the locations of the data questions for that subtest. These values will always be less than 300. To get a listing of this infotable from the Infotable Manager menu, type "L" instead of "3."

INFORMATION TABLE
Test: Arithmetic Reasoning

	1	2	3	4	5	6	7	8
1		108	20	1124	1116	17	406	1013	1518
2		108	1124	20	1116	17	1115	1518	406
3		108	1124	20	1116	17	1115	1518	109
4		1124	108	20	17	1116	1115	109	1518
5		1124	108	20	17	1116	1115	109	516
6		1124	108	17	20	109	1115	516	207
7		1124	108	207	516	109	17	13	1115
8		1124	207	108	13	516	109	806	17
9		207	1124	13	1412	806	516	108	109
10		207	1412	13	725	1124	626	806	516
11		1412	207	725	626	12	13	806	227
12		1412	725	626	12	1424	207	227	1514
13		1412	1424	725	12	428	626	1527	227
14		1412	1424	428	12	725	1527	722	227
15		1412	1424	428	1527	12	1122	618	1110
16		1424	618	428	1412	1110	1122	1527	613
17		618	1110	428	1424	1122	1205	613	1410
18		618	28	822	1205	1110	1410	1122	428
19		929	28	822	618	713	1205	617	312
20		929	822	28	713	617	312	618	7
21		929	7	713	822	28	1305	312	627
22		929	7	1305	19	713	629	1213	1426
23		19	7	1213	1305	929	629	1227	801
24		19	1213	1227	612	14	1305	7	629
25		612	1227	19	1213	14	1321	1029	1305
26		612	1227	14	1029	1213	1321	19	729
27		612	908	1227	729	1029	14	1321	1213
28		908	729	1029	612	1227	14	301	1321
29		908	729	1029	301	1019	1021	612	1227
30		908	1416	729	301	1019	1021	1029	616
31		1416	908	1019	301	1021	729	616	115
32		1416	1019	301	1021	908	616	115	1414
33		1416	1019	616	301	1021	115	1414	921
34		1416	1019	616	921	115	1414	301	1021
35		1416	921	1019	616	1414	115	1411	1018
36		1416	921	1411	1414	616	1019	115	1018

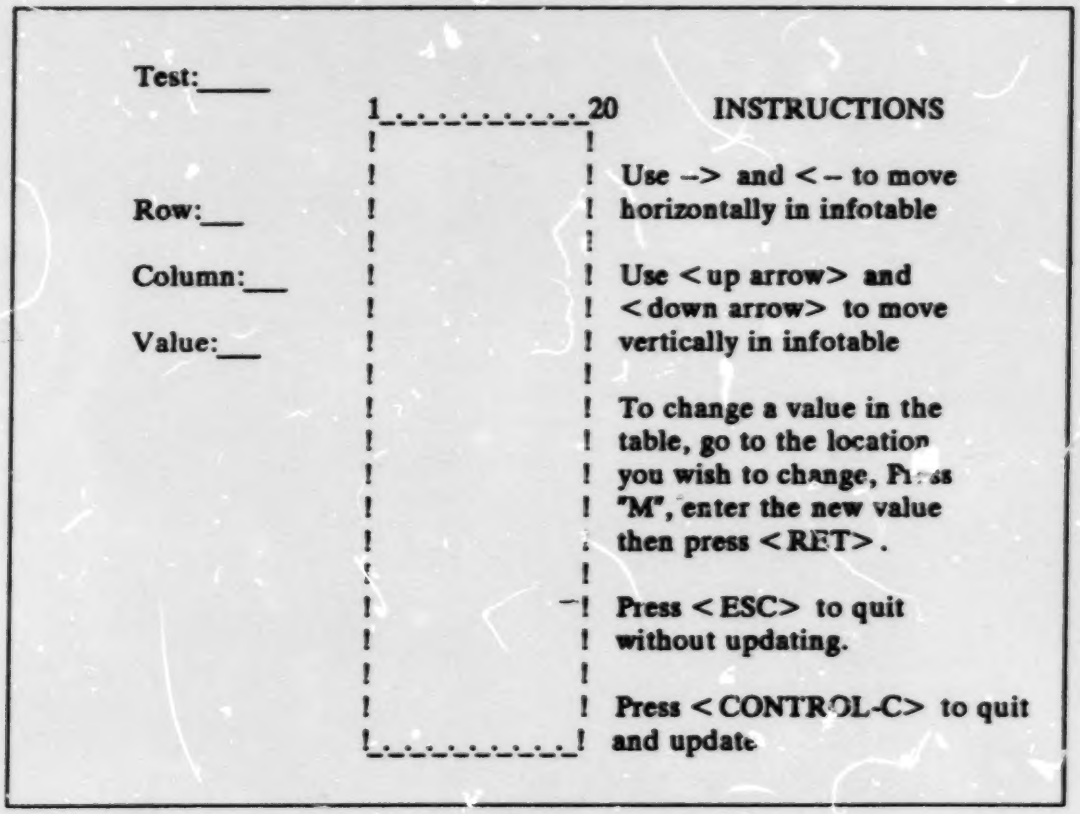
2.4. VERIFY INFOTABLE

Verification consists of checking to see that all of the entries in the infotable also exist in the subtest list of questions. If no question actually exists,

the Test Administration program will be unable to select a question, and the system will fail. The verify option also creates a second table. This second infotable is the one actually used by the Test Administration program. It contains the directory locations of the questions so that no search is required to find a question once it has been selected.

2.5. MODIFY INFOTABLE

This option allows a user to make a change in an individual entry of the infotable. A picture representing the infotable is displayed as follows:



Moving the cursor selects an item in the table, which can then be modified. After an infotable has been modified, the program branches to the "verify" option (see section 2.4) automatically.

2.6. FIND ITEMS IN INFOTABLE

This option allows three basic types of searches to be conducted in the infotable. The user can search for a single item and, if the item is in the infotable, its location will be output. Alternatively, all of the locations of an

item can be found and printed out. The third option allows a user to list the entire data base of a subtest's item code numbers broken into two categories: those that are in the infotable, and those that are not. This last option is important. There are often more than a hundred questions in the data base, and if some of them are included in the infotable (even though their parameters indicate they are not good enough), they just take up extra space and should be removed.

```
                    FIND ITEMS MENU

Select one of the following options by entering its number.

        1. QUIT
        2. FIND A SINGLE ITEM IN INFOTABLE
        3. LIST ALL OCCURRENCES OF AN ITEM TO SCREEN
        4. LIST ALL OCCURRENCES OF AN ITEM TO PRINTER
        5. LIST ALL UNUSED ITEMS TO SCREEN
        6. LIST ALL UNUSED ITEMS TO PRINTER

        Enter choice # :
```

2.6.1. QUIT

Selecting this option in the Find Items menu will cause a branch back to the Infoable Manager menu.

2.6.2. FIND A SINGLE ITEM IN INFOTABLE

This option allows the user to locate the first position (row and column) in the infotable of any item by entering its item code number. The screen prompts and the output are similar to the following diagrams:

```
Item number you wish to find :  2
```

```
ITEM : 2        ROW : 13        COLUMN : 7

Do you want the next location ?   y

ITEM : 2        ROW : 11        COLUMN : 8

Do you want the next location ?   n

Do you want to find a different item ?   n
```

The program searches through the first column, rows 1 to 36, then column 2, and so on until the item is found. After the first location has been found, the remaining locations of that item can be found sequentially if desired. If an item does not exist in the infotable, a message will be displayed to indicate its ommission.

2.6.3,4. LIST ALL OCCURRENCES OF AN ITEM

This option allows the user to get a list the locations (row and column) of a particular item by entering its item code number. After the computer prompts, the output is similar to the following:

```
Subtest : Word Knowledge

Locations in infotable of item : 2

ROW   COL   ROW   COL   ROW   COL   ROW   COL
 13     7    11     8    14     8    10    12
 15    13     9    16

No more locations of item 2

Do you want to find a different item ?   n
```

2.6.5,6. LIST ALL UNUSED ITEMS

This option separates the data base for this subtest into two groups: items that are in the infotable, and those that are not. The program searches the infotable for the first occurrence of each item in the data base. When found, the item goes into a list of items that are "used," that is, they have the

possibility of being called during test administration. If not found, the item goes into a list of unused items. Then it prints the two lists on the screen or on a printer. The screen and the output are similar to the following:

```
Getting the items from file....

Number of items in file : 70

Sorting items . ..

Be patient, I have to compare each of these 70 items
to the infotable..... .....
```

```
List of items found in infotable for : Word Knowledge

  2    5   10   15   17   20   25   27
122  124  125  126  210  222  223  313
327  329  401  402  406  408  410  411
426  427  430  507  510  515  521  522
604  606  609  615  616  620  628  703
717  718  720

List of items not used in : Word Knowledge

  4   11   12   29  204  209  216  224
409  413  416  421  422  501  508  513
529  608  611  613  618  622  623  624
713  715  719
```

2.7. ANALYZE INFOTABLE ROWS

This option allows the user to examine each row of the infotable and then list the data to the screen, printer, or a text file. First a list of the subtests is displayed, as in the following:

LIST OF SUBTESTS

1. Arithmetic Reasoning
2. Numerical Operations
3. Word knowledge
4. General Science

INSTRUCTIONS : Enter choice #, then press <RET>
To escape, press 0, then <RET>

Analyze rows for which subtest?

A subtest is selected by entering its corresponding number. The options available for listing row data are shown:

SELECT OUTPUT MENU

Select one of the following options by entering its number.

1. QUIT
2. LIST ALL ROW DATA
3. LIST ONLY THE SUM OF EACH ROW

Select choice # :

2.7.1. QUIT

Selecting this option from the Select Output menu will cause the program to branch back to the Infotable Manager menu.

2.7.2. LIST ALL ROW DATA

This option will prompt the user for the number of columns in each row to be listed. The program will list up to 20 columns. The row data are then displayed in a table under these entries: the column number, the item code number from the infotable, and the calculated infovalue. After each column, a new sum for theta is also displayed.

2.7.3. LIST ONLY THE SUM OF EACH ROW

This option will first prompt the user for the number of infovalues to be calculated for each row. Only the final sums of each row will be displayed;

individual item codes and infovalues are not shown. Once the number of infovalues per row is selected, the Select Output menu will be revised to appear as follows:

```
                    SELECT OUTPUT MENU

Select one of the following procedures by entering its number.

        1. QUIT
        2. LIST ROW DATA TO SCREEN
        3. LIST ROW DATA TO PRINTER
        4. LIST ROW DATA TO TEXT FILE


        Enter choice # :
```

2.7.3.1 QUIT

This option in the revised Select Output menu will cause the program to branch to the Strategy Data Base menu.

2.7.3.2,3,4 LIST ROW DATA

Selecting one of these options will list the calculated values of theta to a printer, screen, or a text file. A partial sample of the output for the selection (4 out of 36 row values) of two infovalues follows:

```
SUBTEST : General Science

THETA : -2.25000e+00     SUM :  9.72199e-01
THETA : -2.12500e+00     SUM :  1.01658e+00
THETA : -2.00000e+00     SUM :  1.03010e+00
THETA : -1.87500e+00     SUM :  1.02926e+00
```

SUBTEST : Word Knowledge

Theta : -1.87700e+00

Col	Item#	Infovalue	Col	Item#	Infovalue	Col	Item#	Infovalue
1	1209	1.1266031	2	521	0.8547747	3	1012	0.8057737

Sum for THETA = -1.87700e+00 : 2.78715e00

Press <return> to continue

After the row data have been listed to a device, the program will branch to the Graph menu.

GRAPH MENU

Select one of the following options by entering its number.

1. NO GRAPH
2. DISPLAY GRAPH ON SCREEN
3. DISPLAY GRAPH ON PRINTER
4. WRITE GRAPH OUT TO FILE

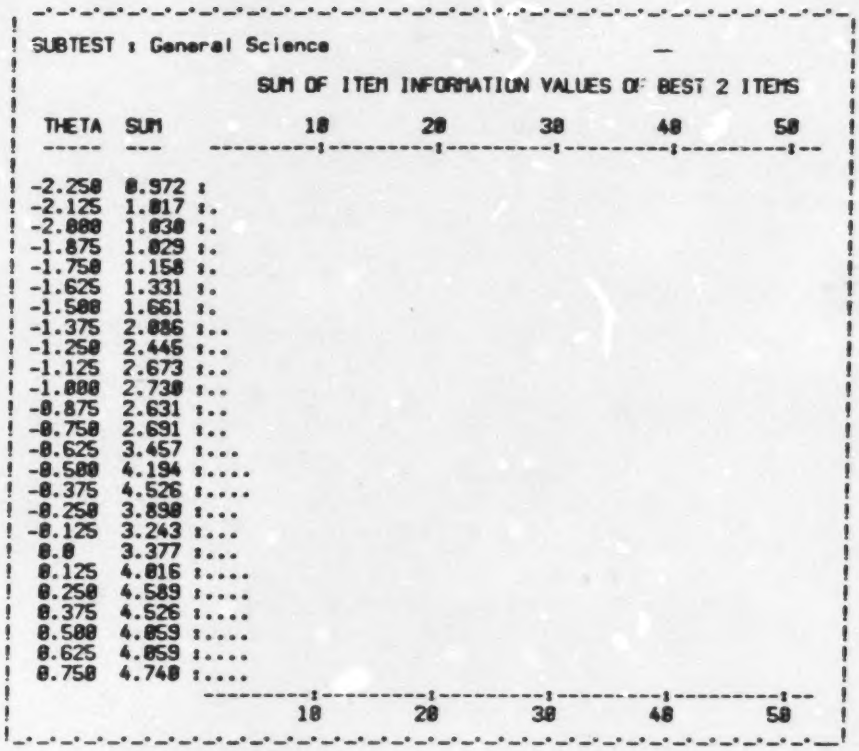
Enter choice # :

2.7.3.(2,3,4).1 NO GRAPH

This selection will cause the program to branch back to the Infotable Manager menu.

2.7.3(2,34).2,3 DISPLAY GRAPH ON PRINTER OR SCREEN

A histogram of the sum of the chosen infovalues is listed to the screen or printer. A partial sample follows:



SUBTEST : General Science

SUM OF ITEM INFORMATION VALUES OF BEST 2 ITEMS

THETA	SUM	10	20	30	40	50
-2.250	0.972	:				
-2.125	1.017	:.				
-2.000	1.030	:.				
-1.875	1.029	:.				
-1.750	1.158	:.				
-1.625	1.331	:.				
-1.500	1.661	:.				
-1.375	2.086	:..				
-1.250	2.446	:..				
-1.125	2.673	:..				
-1.000	2.730	:..				
-0.875	2.631	:..				
-0.750	2.691	:..				
-0.625	3.457	:...				
-0.500	4.194	:....				
-0.375	4.526	:....				
-0.250	3.898	:...				
-0.125	3.243	:...				
0.0	3.377	:...				
0.125	4.016	:....				
0.250	4.589	:....				
0.375	4.526	:....				
0.500	4.059	:....				
0.625	4.059	:....				
0.750	4.748	:....				
		10	20	30	40	50

2.7.3(2,3,4).4 WRITE GRAPH OUT TO FILE

This option writes the graph to a file; if no file name is given, the program will save STRAT-INFO.TEXT. Upon completion of any of the Graph menu options, the program will branch back to the Infotable Manager menu.

SECTION 7
GRAPHICS EDITOR PROGRAM
(MENU OPTION 7)

The Graphics Editor program allows the computer to create pictures that can be saved as subtest questions. Available options include certain editing features such as drawing polygons, allowing characters in graphics, line drawings, and graphics compression routines. The graphics editor may be run by selecting option 7 in the CAT Project menu or by directly executing "CATDATA:G.MGR." See figure below:

```
GRAPHICS MANAGER LIST OF SUBTESTS [1.03]

1. Arithmetic Reasoning      3. Word Knowledge
2. Numerical Operations      4. General Science

INSTRUCTIONS : Enter choice #, then press <RET>.
               To escape, press 0, then <RET>.

Edit graphics for which subtest ? :
```

The user selects a subtest for graphics editing by pressing the number next to the subtest. If the user presses "0" to quit the program, control is branched back to the CAT Project menu. If a subtest is selected, then the user is put in the graphics editing mode. The screen is first cleared and then appears as follows:

```
SUBTEST :
Slow cursor          Fast cursor  Draw   Write file  New
<keypad #'s draw>    Polygon      Home   Read file   Krunch
<arrows to move>     Characters   Erase  Line        Quit
```

Because graphics pictures are done in inverse, the screen will appear white. The bottom four lines of the screen give information about the subtest being used and the available options for graphics editing. Some of these are described in the following list:

SLOW CURSOR: Pressing "S" will set the pixel cursor to normal speed. The arrows that move the pixel cursor will move one pixel at a time.

<KEYPAD #'S DRAW>: Pressing any of the numeric keys will plot a point or erase a point depending upon whether the user is in draw mode or erase mode. The keypad numbers move in the following directions: 1--SW, 2--S, 3--SE, 4--W, 5--current location, 6--E, 7--NW, 8--N, and 9--NE.

<ARROWS TO MOVE>: Pressing any of the four arrows: up, down, left, and right, will move the pixel cursor in that direction without plotting or erasing a point.

FAST CURSOR: Pressing "F" will set the pixel cursor to fast speed, which is useful to move across the graphics screen to get to a desired location. The pixel cursor will move eight pixels with one press of the arrow key.

POLYGON: Pressing a "P" will let the user draw polygons of various sizes and shapes. The pixel cursor must be moved to the location where the bottom of the polygon is desired before this option is selected. After pressing "P," the user is asked : " What size polygon ? "

This input will set the number of pixels per side of the polygon. Typical input ranges from 4 to 20. It is best to experiment with this option first to get a feel for relative polygon sizes with relation to input. Next the user is asked : " How many sides ? "

This input will set the number of sides in the geometric figure. This number must be 4 or larger. 4 will draw a square, and large numbers will approximate circles. After this input, the polygon is drawn and the user is put back into graphics editing.

CHARACTERS: Pressing "C" will put you into the character mode for the graphics editor. The character cursor is put in the lower left corner and characters may be entered onto the graphics screen. The arrows move the character cursor. To leave the character mode, press <ESCAPE> and the pixel cursor will be put back in the lower left corner.

DRAW: Pressing "D" will set the numeric keys in the draw mode. They will plot a pixel in the following directions corresponding to the following keys: 1--SW, 2--S, 3--SE, 4--W, 5--current location, 6--E, 7--NW, 8--N, and 9--NE.

HOME: Pressing an "H" will move the pixel to the lower-left corner of the graphics screen. This option is useful when you have no idea where you are on the graphics screen and you want to go to some reference point.

ERASE: Pressing "E" will put the numeric keypad in the erase mode. "E" will erase whatever lies in the path of the pixel cursor.

WRITE FILE: This option writes whatever is on the graphics screen to a graphics file as a subtest question, or a subtest sample question, or to a file name specified by the user. The following menu is given:

> **WRITE GRAPHICS MENU**
>
> Select one of the following options by entering its number.
>
> 1. QUIT
> 2. WRITE OUT AS SUBTEST QUESTION
> 3. WRITE OUT AS SUBTEST SAMPLE QUESTION
> 4. WRITE TO SPECIFIED FILENAME
>
> Enter choice # :

1. QUIT

This option terminates the Write Graphics menu and returns the user to the graphics editor.

2. WRITE OUT AS SUBTEST QUESTION

This option writes the current state of the graphics screen to a fotofile in the appropriate subdirectory on the volume CATFOTO. A file name corresponding to a name expected by Test Administration is automatically created for the fotofile.

3. WRITE OUT AS SUBTEST SAMPLE QUESTION

This option writes the current state of the graphics screen to a fotofile in the appropriate subdirectory on the volume CATFOTO. A file name corresponding to a name expected by Test Administration is automatically created for the foto file.

4. WRITE TO SPECIFIED FILENAME

This option asks the user for a specific file name in which to save the graphics screen. The picture is saved as a fotofile. This option is useful for saving pictures that are not necessarily test questions, such as the Test Administration session header CATPIC.FOTO, which is a picture of a leopard leaping over a computer.

READ FILE: Pressing an "R" will read a graphics file from the volume CATFOTO or some other specified volume. A menu appears as follows:

READ GRAPHICS MENU

Select one of the following options by entering its number.

1. QUIT
2. READ SUBTEST QUESTION
3. READ SUBTEST SAMPLE QUESTION
4. READ GRAPHICS FROM FILENAME

Enter choice # :

1. QUIT

This option terminates the Read Graphics menu and returns the user to the grapnics editor.

2. READ SUBTEST QUESTION

This option reads a fotofile or compressed graphics file from the volume CATFOTO and displays it on the graphics screen. First the item code of the question is requested. The procedure will look for a fotofile on the appropriate CATFOTO subdirectory and, if it does not exist, will look for a compressed graphics file. If it cannot find this either, it displays an error message. The picture displayed on the screen can be edited.

3. READ SUBTEST SAMPLE QUESTION

This option performs the same function as reading a subtest question, except that the subtest sample question number is requested instead of the question item code.

4. READ GRAPHICS FROM FILENAME

This option asks the user for a specific file name to load the graphics file from. If it does not exist, an error message is displayed; otherwise the picture is put on the screen and editing is allowed.

LINE: Pressing "L" will draw a straight line from the current pixel cursor location to the last point plotted on the graphics screen.

NEW: Pressing "N" will clear the graphics screen so that the user can start over. This option is used when the current picture is a hopeless case. First the user is asked: "Start new graphics screen? Y/N :" If "Y" is pressed,

the entire graphics screen will be cleared. If "N" is selected, the user is returned to the graphics editor as if nothing had happened.

KRUNCH: Pressing "K" will write the current contents of the graphics screen to a graphics data file that is typically four blocks in size. It is used in place of fotofiles for Test Administration if the response time (time to display) is quick enough. The following menu is first given:

KRUNCH GRAPHICS MENU

Select one of the following options by entering its number.

1. QUIT
2. KRUNCH AS SUBTEST QUESTION
3. KRUNCH AS SUBTEST SAMPLE QUESTION
4. KRUNCH TO SPECIFIED FILENAME

Enter choice # :

1. QUIT

This option terminates the Krunch Graphics menu and returns the user to the graphics editor.

2. KRUNCH AS SUBTEST QUESTION

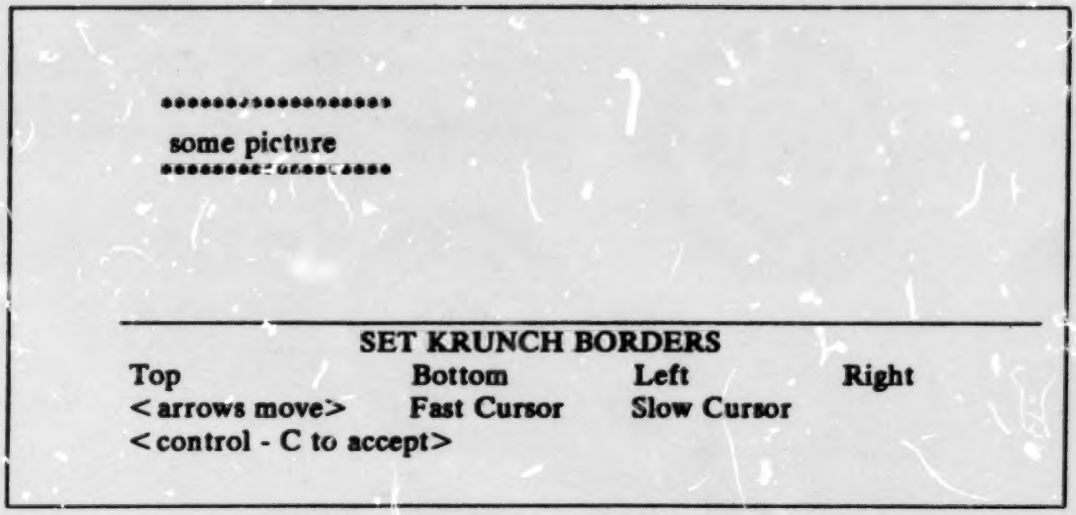
This option sets the file name for the compressed graphics file to be written to the appropriate subdirectory on the volume CATDATA. First, the question item code is requested. If a compressed file exists already for the question, the computer will ask if the user wishes to destroy the old file.

3. KRUNCH AS SUBTEST SAMPLE QUESTION

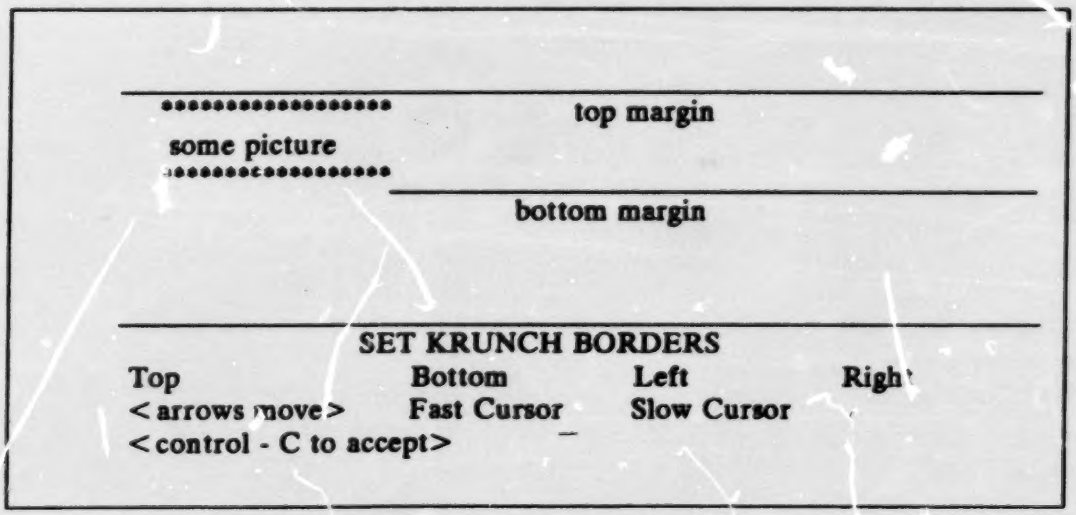
This option performs the same function as krunching a subtest question except that the subtest sample question number is requested instead of the question item code.

4. KRUNCH TO SPECIFIED FILENAME

This option asks the user for a specified file name for the graphics file. After the user has chosen where to send the graphics compressed file, borders must be set to dictate the area to be krunched. This option allows compressing of the entire graphics screen or some subportion of the screen. The screen will appear as follows:



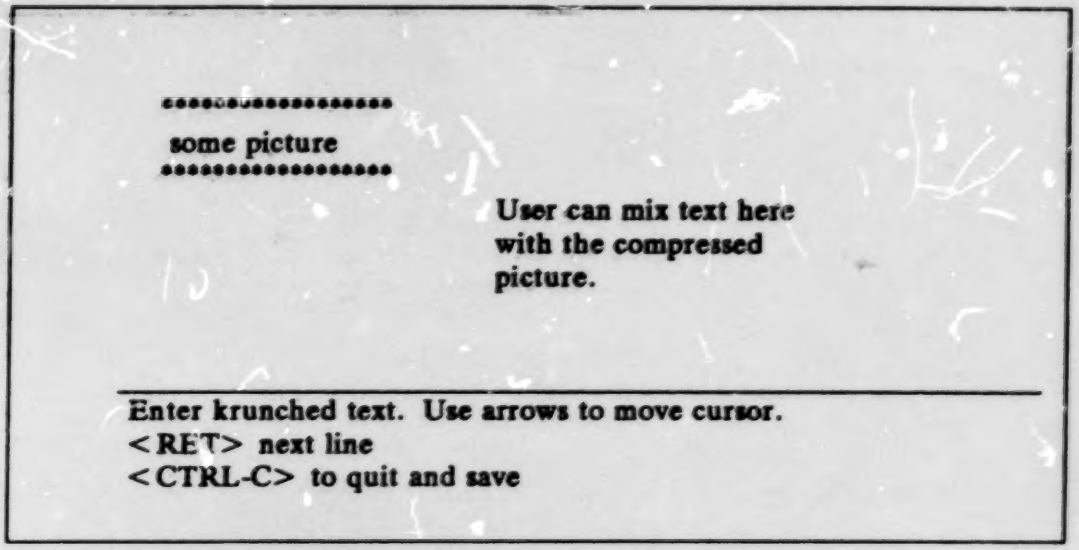
Initially the borders are defaulted to the entire screen. To select a subportion of the screen to compress, move the pixel cursor to the location where you wish to set a margin, then press T, B, L, or R for the respective options of top, bottom, left, or right margin. If you make a mistake, just move the pixel cursor to the location you want and set the margin again. It is recommended that the margins be set to contain the picture in as little area as possible to shorten the compression time. Compressing the entire screen will take approximately an hour, whereas selecting some subportion of the screen will greatly reduce the time. Whenever a margin is set, a line will be drawn to show where it is. The following is an illustration of a graphics screen with the top and bottom margins set:



After all the desired margins are set, press <CONTROL-C> to accept the margins and begin krunching. Messages will appear at the bottom of the

screen describing what is happening to the graphics picture. These messages are "Krunching fotofile," "Coding horizontal lines," "Coding vertical lines," "Coding diagonal lines," and "Coding dots." When the picture has been compressed, a message will appear at the bottom: "Krunching is completed. Press <RET> to continue."

After pressing <RETURN>, characters can now be added to the compressed picture. The picture is displayed again and the user is put in a character editor as follows:



Due to the nature of the display of the character information, no part of the graphics picture may appear between characters on the same line of the screen. Otherwise, that portion of the graphics picture will be erased.

After entering the desired text, press <CONTROL-C>. The computer will indicate that the text is being entered. After the characters are written to the file, the entire picture is displayed again, with the characters just entered. The user is prompted to press the <RETURN> key to continue.

After this, the time required to display the picture is listed. This information is necessary to determine which pictures should be used as fotofiles and which as compressed graphics. The current criterion requires that the response time of a compressed graphics picture be 5 seconds or less; otherwise fotofile storage is used.

After pressing <RETURN> again, the picture remains on the graphics screen, and the user is returned to the graphics editor with the main options again.

QUIT: Pressing "Q" exits the graphics editor and returns to the Graphics Manager list of subtests.

SECTION 8
CAT SYSTEM DIAGNOSTICS PROGRAM
(MENU OPTION 8)

The System Diagnostics program was designed to debug and verify new and existing systems. It checks the infotables, graphics files, and item text of the subtests. It may be run by selecting the CAT System Diagnostics option from the CAT Project menu or by directly executing CATDATA:D.MGR. The available options are described below:

CAT SYSTEM DIAGNOSTIC MENU [1.05]

Select one of the following procedures by entering its number.

1. QUIT
2. CHECK INFOTABLES
3. CHECK GRAPHICS FILES
4. LOOK FOR DUPLICATE/SIMILAR QUESTIONS

Enter choice # :

1. QUIT

This option terminates the CAT System Diagnostics program and then branches back to the CAT Project menu.

2. CHECK INFOTABLES

Selecting this option will check the validity of data in the information tables for all the subtests and display the results as follows:

Subtest	# of infotable errors
Word Knowledge	0
General Science	0
Arithmetic Reasoning	0
Numerical Operations	720

Do you want to list the errors? Y/N :

An additional option exists to list the errors by item codes to the console, file, or printer. For tests with no infotables, it is normal for 720 errors to occur. An error in an infotable means that the infotable is referencing a nonexistent question. The infotable must be regenerated or corrected and then reverified through the Stategy Data Manager.

3. CHECK GRAPHICS FILES

This option checks all the items for the subtests to verify that if the graphics flag is set, the appropriate graphics file exists on the volume CAT-FOTO in the correct subdirectory. The program displays the number of graphics files for a subtest and the errors that occurred. These errors indicate that a graphics flag is set with no corresponding fotofile or compressed graphics file in the system. Errors can be listed to the screen, printer, or text file.

Subtest	# or graphics	foto errs	krunch errs
Word Knowledge	0	0	0
General Science	4	0	0
Arithmetic Reasoning	2	0	0
Numerical Operations	0	0	0

Do you want to list the errors ? Y/N :

4. LOOK FOR DUPLICATE/SIMILAR QUESTIONS

The CAT system duplicate question search procedure scans through a specified subtest and creates a list of questions that may be identical or similar. It extracts a given number of key words (the longest words, the number specified by the user), compares the key words to the key words of other questions, and notes the number of matches that occur. Similar and identical questions will have a greater number of matching key words.

Three bits of information are required by the program :

1. THE SUBTEST TO SCAN. A list of subtests is presented and the user specifies the subtest to search for duplicate or similar questions.

2. NUMBER OF KEYS TO EXTRACT. The program allows a maximum of ten key words to be extracted per question. The user adjusts the level of analysis by specifying how many key words to get.

3. MINIMUM CRITERION FOR MATCH. The user is requested to specify the number of key words that must match before a question is considered to be similar to another.

For large subtests (more than 150 questions), the program will require about 40 minutes to execute. This time will vary according to the number of key words to extract and the minimum criterion. Smaller values for these use slightly less time. (Note: Smaller values of the minimum criterion may result in finding too many matches on insignificant key words, which may cause a stack overflow. If stack overflow occurs, one should raise the minimum criterion.)

When the text scanning is complete, the program will list question pairs that are similar, based on how many key words matched. The user has the option of sending this information to the screen, printer, or a text file at this point. The output consists of item code pairs of similar questions. With these item codes, the user can also output the text of the possible similar questions. The screen output for the search procedure will be similar to the following example:

RECOMMENDED VALUES

(# keywords to extract)

Subtest	Level of Analysis	Minimum Criterion
Word Knowledge	8	5
General Science	10	6
Arithmetic Reasoning	10	6
Mathematics Knowledge	8	5
Paragraph Comprehension	10	6
ALL Numerical Operations	n/a	n/a
PC2	10	6
Automotive Information	10	6
Electronics Information	10	6
ALL Coding Speed	n/a	n/a
Shop Information	10	6
MC2	n/a	n/a
AR2	10	6
EI2	10	6

SECTION 9
ON-LINE USER DOCUMENTATION PROGRAM
(MENU OPTION 9)

The User Documentation program provides access to the documentation that is stored on the Corvus disk. These documentation files can be viewed at a terminal or listed to a printer. Once the USERDOC option has been selected from the main program menu, a brief description of the program is displayed on the terminal screen. The alpha lock key should be depressed when running this program. A bell sounds if an incorrect key is pressed when selecting menu options. Note: To use this option, the user must have a 20-megabyte Corvus disk drive.

USERDOC OPTION

This program provides the user with the option of having documentation files displayed at the terminal or listed to a printer. The text of a file appearing on the terminal will be displayed only 20 lines at a time. The user can escape the viewing option or print the text of the file. After each request is completed the program will return to a main options menu.

Press the <return> key to continue the program :

After the user presses the return key, the USERDOC Main menu will appear, offering five options. One exits the program, and another prints a hard copy of the complete documentation file directory. Of the remaining three options, only one, Display Documentation Directory, provides the user with the names of the documentation files. The remaining two options assume that the user knows the necessary file name. Unless a specific file is to be examined, it is recommended that option 2, Display Documentation Directory, be used.

USERDOC MAIN MENU

Select one of the options by entering its number

1. QUIT
2. DISPLAY DOCUMENTATION DIRECTORY
3. DISPLAY A PRESELECTED FILE ON SCREEN
4. PRINT COMPLETE DOCUMENTATION SUBDIRECTORY
5. PRINT A PRESELECTED FILE

Enter Item Choice # :

1. QUIT

Selecting this option will cause the program to exit the USERDOC program and branch back to the CAT Project menu.

2. DISPLAY DOCUMENTATION DIRECTORY

This option will first display a listing of the subdirectory headings available to the user. Once a subdirectory has been chosen, the files in the subdirectory are displayed as in the list that follows. The user may now chose to view a file in the subdirectory, print a single file, or have a whole subdirectory printed. Once this routine has completed the requested option, it automatically branches back to the Userdoc Main menu.

PRIMARY DIRECTORY FILES

Select desired subdirectory by entering its letter.

A. FEATURES
B. REQUIREMENTS
C. PROGRAM DESCRIPTION
D. PROJECT STRUCTURE
E. FILE STRUCTURE
F. USER DOCUMENTATION
G. ADMINISTERING A TEST
H. SYSTEM PARAMETER MANAGEMENT
I. SYSTEM/ITEMPOOL MANAGEMENT
J. EXAMINEE MANAGEMENT
K. STRATEGY DATA MANAGEMENT
L. GRAPHICS MANAGER

PRESS THE <ESC> KEY TO RETURN TO THE MAIN MENU

Enter Item Choice letter :

The only way to exit the Primary Directory Files menu without having the computer perform any additional options is to press the <ESCAPE> key. Pressing the letter "A" will cause the screen to appear as follows:

The Subdirectory FEATURES contains 5 Files

A.) QUIT
B.) /DOC/FEATURES/A1
C.) /DOC/FEATURES/A2
D.) /DOC/FEATURES/A3
E.) /DOC/FEATURES/A4
F.) /DOC/FEATURES/A5

Enter Item Choice Letter :

If option "A" is chosen, the program branches back to the USERDOC Main menu. Once a documentation file is chosen, it is scrolled on the terminal 20 lines at a time. If item letter "B" had been selected, the terminal would appear as follows:

```
FILENAME : /DOC/FEATURES/A.1.TEXT

PRESS THE <YES> KEY TO PRINT A FILE
PRESS THE <NO> KEY TO VIEW THE FILE
PRESS THE <ESC> KEY TO EXIT THIS PROCEDURE
```

Pressing the escape key from this display will cause the program to branch to the USERDOC Main menu. Pressing the "NO" key will start scrolling the text of the selected file on the screen, as shown in the following example:

```
CURRENTLY VIEWING: /DOC/FEATURES/A1.TEXT


MINIMAL REQUIREMENTS FOR A CAT SYSTEM
(Dewitt and Weiss, 1974)

1. Select a test item from an item pool following a
   predetermined set of instructions.

2. Present the item on a CRT or other display unit.

3. Accept a response.

4. Check response for validity and compatibility with the
   instructional sequence.

5. Determine whether the response is correct or incorrect.

6. Calculate the response latency (time required to answer
   the question).

TO CONTINUE VIEWING PRESS <RET>     ELSE PRESS <ESC> :
```

Pressing the <RETURN> key will continue the scrolling. If the <ESCAPE> key is pressed, the program will branch back to the USERDOC Main menu. When the end of the file is reached, a prompt is displayed at the bottom of the screen which says "TO CONTINUE PRESS <RETURN>." When the <RETURN> key is pressed, the program branches to the USERDOC Main menu.

Pressing the "YES" key will allow the option of printing the file or its subdirectory. The option of printing a subdirectory is very useful because each file is only a 64-line page of the multipage subdirectory, and, in most instances, the whole subdirectory will probably need to be printed for continuity of understanding. Pressing the "YES" key brings up the following screen:

```
Press the <return> key to have DOC/FEATURES/A.1.TEXT printed

Press the <yes> key to print the subdirectory
```

The program will branch back to the USERDOC Main menu once the desired print option is completed.

3. DISPLAY A PRESELECTED FILE ON SCREEN

Selecting this option displays the following screen:

```
PLEASE ENTER FILE YOU WISH TO VIEW

FILENAME :
```

If the user knows the pathname of a particular documentation file, this option allows the subdirectory menus to be bypassed and the file to be immediately displayed. The program checks for a volume directory prefix (/DOC/), and a ".TEXT" suffix on the requested file name. If any of these are missing, and if the subdirectory name and file name are still correct, the program will concatenate them to the file name and then display the file on the terminal. If an incorrect file name is entered, the following error message is displayed for about 10 seconds:

```
***** INCORRECT FILENAME *****
```

The program branches back to the USERDOC Main menu after an input error is detected or the user completes viewing a file.

The text of the chosen file will scroll on the screen. Pressing the <ESCAPE> key will return the user to the USERDOC Main menu.

4. PRINT COMPLETE DOCUMENTATION SUBDIRECTORY

This option will list all the documentation files to a printer, creating a hard copy of the CAT system documentation. The program first double-checks with the user to be sure that the whole catalog is to be printed:

```
ARE YOU SURE YOU WANT ALL 130 PAGES PRINTED?
Press the <yes> key to continue, the <no> key to exit :
```

Once the program begins printing the complete documentation files, pressing any key on the keyboard will terminate the operation and return the program to the USERDOC Main menu. The file names being printed are listed under the banner message as they are completed:

```
**********************************************************************
*                                                                    *
* ENTIRE DOCUMENTATION CATALOG BEING PRINTED                         *
*                                                                    *
*  Pressing any key on the keyboard will terminate this process      *
*                                                                    *
**********************************************************************

/DOC/FEATURES/A0.TEXT
/DOC/FEATURES/A1.TEXT
/DOC/FEATURES/A2.TEXT
      . .
      . .
/DOC/D.GMGR/L9.TEXT
```

5. PRINT A PRESELECTED FILE

This option will list to a printer the contents of a single documentation

file. The correct file name must be entered at the prompt, or an error message will appear for 10 seconds, and the program will branch back to the USER-DOC Main menu.

```
Enter filename to be printed :
```

```
Enter filename to be printed : xxxxxxx

****** INCORRECT FILENAME ******
```

The program automatically checks for a correct "/DOC/" prefix and ".TEXT" suffix on the file name and supplies them if the file and subdirectory names are correct. When the file has been listed to the printer, the program will branch back to the USERDOC Main menu.

SECTION 10
GRAPHICS INFORMATION

This section describes the current state of the graphics files on the volume CATFOTO. It relects the data stored for each question. If the graphics flag is set, the graphics information for the question is displayed. Many questions have graphics files on the volume, but the flag is not set to use these graphics. Also, many graphic files exist on the volume without a question entered into the data base.

The information here applies only to graphics for questions with the flags set. These questions expect graphics during the test administration.

Subtest : General Science
Volume : /CATFOTO/BDIR

item code	file name	file type	display time (sec)
703	gbq703.foto	fotofile	4
919	gb919.data	compressed	2
1012	gb1012.data	compressed	3
1129	gbq1129.foto	fotofile	4

Subtest : Arithmetic Reasoning
Volume : /CATFOTO/CDIR

item code	file name	file type	display time (sec)
211	gc211.data	compressed	5
301	gc301.data	compressed	4

Subtest : Mathematics Knowledge
Volume : /CATFOTO/DDIR

item code	file name	file type	display time (sec)
23	gdq23.foto	fotofile	4
109	gd109.data	compressed	2
115	gd115.data	compressed	3
119	gd119.data	compressed	2
123	gdq123.foto	fotofile	4
406	gdq406.foto	fotofile	4

426	gdq426.foto	fotofile	4
516	gd516.data	compressed	2
703	gdq703.foto	fotofile	4
818	gd818.data	compressed	3
826	gd826.data	compressed	4
901	gd901.data	compressed	4
923	gd923.data	compressed	4
1014	gd1014.data	compressed	3
1214	gd1214.data	compressed	4
1224	gd1224.data	compressed	5
1302	gdq1302.foto	fotofile	4
1323	gd1323.data	compressed	3
1421	gd1421.data	compressed	2

Subtest : Automotive Information
Volume : /CATFOTO/HDIR

item code	file name	file type	display time (sec)
21	ghq21.foto	fotofile	4
26	ghq26.foto	fotofile	4
214	ghq214.foto	fotofile	4
514	ghq514.foto	fotofile	4
528	ghq528.foto	fotofile	4
726	gh726.data	compressed	4
1013	gh1013.data	compressed	4
1026	ghq1026.foto	fotofile	4
1303	ghq1303.foto	fotofile	4
1322	ghq1322.foto	fotofile	4

Subtest : Mechanical Comprehension
Volume : /CATFOTO/IDIR

item code	file name	file type	display time (sec)
801	giq801.foto	fotofile	4
802	giq802.foto	fotofile	4
803	gi803.data	compressed	4
804	gi804.data	compressed	4
805	giq805.foto	fotofile	4
806	giq806.foto	fotofile	4
807	giq807.foto	fotofile	4
808	gi808.data	compressed	5
809	giq809.foto	fotofile	4

810	giq810.foto	fotofile	4
811	gi811.data	compressed	4
812	gi812.data	compressed	4
813	giq813.foto	fotofile	4
814	giq814.foto	fotofile	4
815	giq815.foto	fotofile	4
816	giq816.foto	fotofile	4
818	giq818.foto	fotofile	4
819	giq819.foto	fotofile	4
820	giq820.foto	fotofile	4
821	gi821.data	compressed	5
822	giq822.foto	fotofile	4
823	giq823.foto	fotofile	4
824	giq824.foto	fotofile	4
825	gi825.data	compressed	5
901	giq901.foto	fotofile	4
902	giq902.foto	fotofile	4
903	giq903.foto	fotofile	4
904	giq904.foto	fotofile	4
905	giq905.foto	fotofile	4
906	gi906.data	compressed	5
908	giq908.foto	fotofile	4
909	giq909.foto	fotofile	4
910	giq910.foto	fotofile	4
911	gi911.data	compressed	5
912	giq912.foto	fotofile	4
913	giq913.foto	fotofile	4
914	giq914.foto	fotofile	4
915	giq915.foto	fotofile	4
916	giq916.foto	fotofile	4
917	gi917.data	compressed	4
918	giq918.foto	fotofile	4
921	gi921.data	compressed	5
922	gi922.data	compressed	5
923	giq923.foto	fotofile	4
924	giq924.foto	fotofile	4
925	gi925.data	compressed	4
1001	gi1001.data	compressed	5
1002	gi1002.data	compressed	4
1003	giq1003.foto	fotofile	4
1004	gi1004.data	compressed	5
1005	giq1005.foto	fotofile	4
1006	giq1006.foto	fotofile	4
1007	giq1007.foto	fotofile	4
1008	gi1008.data	compressed	4
1009	giq1009.foto	fotofile	4
1010	gi1010.data	compressed	5

1011	giq1011.foto	fotofile	4
1012	giq1012.foto	fotofile	4
1013	giq1013.foto	fotofile	4
1014	giq1014.foto	fotofile	4
1016	giq1016.foto	fotofile	4
1017	giq1017.foto	fotofile	4
1018	giq1018.foto	fotofile	4
1019	giq1019.foto	fotofile	4
1020	giq1020.foto	fotofile	4
1021	gi1021.data	compressed	5
1022	giq1022.foto	fotofile	4
1023	gi1023.data	compressed	5
1024	giq1024.foto	fotofile	4
1025	giq1025.foto	fotofile	4

Subtest : Electronics Information
Volume : /CATFOTO/JDIR

item code	file name	file type	display time (sec)
802	gj802.data	compressed	5
904	gjq904.foto	fotofile	4
915	gjq915.foto	fotofile	4
1002	gjq1002.foto	fotofile	4
1005	gj1005.data	compressed	2
1007	gj1007.data	compressed	4
1009	gjq1009.foto	fotofile	4

Subtest : MK2
Volume : /CATFOTO/QDIR

item code	file name	file type	display time (sec)
2022	gq2022.data	compressed	4

Subtest : Shop Information
Volume : /CATFOTO/RDIR

item code	file name	file type	display time (sec)
16	gr16.data	compressed	3
112	gr112.data	compressed	4
119	gr119.data	compressed	5

204	grq204.foto	fotofile	4
212	grq212.foto	fotofile	4
313	gr313.data	compressed	4
316	gr316.data	compressed	5
327	gr327.data	compressed	4
401	grq401.foto	fotofile	4
403	gr403.data	compressed	3
406	gr406.data	compressed	3
412	grq412.foto	fotofile	4
423	grq423.foto	fotofile	4
429	grq429.foto	fotofile	4
511	gr511.data	compressed	4
522	gr522.data	compressed	4
523	grq523.foto	fotofile	4
524	gr524.data	compressed	4
527	gr527.data	compressed	2
608	no file		
609	grq609.foto	fotofile	4
622	no file		
801	gr801.data	compressed	3
814	grq814.foto	fotofile	4
818	grq818.foto	fotofile	4
819	gr819.data	compressed	3
912	grq912.foto	fotofile	4
924	grq924.foto	fotofile	4
929	gr929.data	compressed	2
1016	gr1016.data	compressed	3
1023	grq1023.foto	fotofile	4
1028	grq1028.foto	fotofile	4
1103	grq1103.foto	fotofile	4
1106	grq1106.foto	fotofile	4
1121	grq1121.foto	fotofile	4
1127	gr1127.data	compressed	3
1224	gr1224.data	compressed	5
1303	gr1303.data	compressed	4
1310	gr1310.data	compressed	3
1314	gr1314.data	compressed	4
1322	grq1322.foto	fotofile	4
1323	grq1323.foto	fotofile	4
1326	gr1326.data	compressed	2
1404	grq1404.foto	fotofile	4
1411	gr1411.data	compressed	4
1523	gr1523.data	compressed	3

Subtest : MC2
Volume : /CATFOTO/SDIR

item code	file name	file type	display .ime (sec)
111	gs111.data	compressed	5

Subtest : EI2
Volume : /CATFOTO/UDIR

item code	file name	file type	display time (sec)
741	no file		
744	gu744.data	compressed	5
752	guq752.foto	fotofile	4
762	guq762.foto	fotofile	4
769	gu769.data	compressed	2
773	no file		
783	gu783.data	compressed	4
795	no file		
803	no file		
808	guq808.foto	fotofile	4
812	no file		
822	gu822.data	compressed	5
830	no file		
848	gu848.data	compressed	5
851	guq851.foto	fotofile	4
865	no file		
866	gu866.data	compressed	3
871	no file		
887	gu887.data	compressed	2
7103	gu7103.data	compressed	4
8105	no file		

SECTION 11
MISCELLANEOUS ASSOCIATED PROGRAMS

The following utility programs play no direct role in the CAT system but were used to format the data files and maintain the system or were developed for experimental purposes.

NEITHER OF THE TWO PROGRAMS THAT FOLLOW SHOULD BE USED UNLESS ABSOLUTELY NECESSARY. THEY HAVE THE POTENTIAL TO RUIN YOUR SYSTEM.

Program : CATFFORMAT.TEXT
Volume : /TFILES/MISC.DIR

Description: This program was used to initialize the format and size of all files in the CAT system. If it is used again inappropriately, it will destroy all existing data.

Program : CATKRUNCH.TEXT
Volume : /TFILES/MISC.DIR

Description: No garbage collection exists for ASCII text in a question when the item is deleted or modified. All new text is added to the end of the file on volume QTEXT. If space runs out on QTEXT, this program may help rewrite the entire ASCII file into a smaller size, eliminating the unused space.

Additional experimental programs include :

F.TMGR.TEXT exists on /TFILES/FTMGR.DIR with its associated files. It is a floppy disk version of Test Data Base Management. In the T.MGR program, there is an option that writes a subtest to a floppy. F.TMGR is the program that can read this floppy.

PEXP.MGR.TEXT exists on a floppy disk with its associated files. It is a floppy version of the Parameter Setup for the test administration. It will set up a file for a floppy version of the test administration program

CAT.F1 exists on a floppy disk with its associated files. It is a floppy version of the test administration program. It will load subtests from floppies instead of the Corvus disk and will not handle graphics.

CROSSREF.TEXT exists on a floppy disk with its associated files. It is a detailed cross-reference generator that gives information on variables: where they were declared, what line they were referenced on, and their type. It doesn't handle large programs well because of stack overflow. It will read "include" files.

These experimental programs may not be compatible with the current CAT system implementation.

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